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AUTHOR Bland, Laurel LeMieux
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ABSTRACT

The study determined if a significant difference was demonstrated between American Indians and Caucasians on visual perception and recall tasks associated with cognitive function. It was hypothesized that a significant difference existed between scores obtained by Indian children enrolled in reservation schools and that of Caucasian children enrolled in public schools of adjacent non-reservation urban communities, and between children from the different Indian tribes in scores obtained using the Visual Recall Ability Indicator. Any demonstrated difference was related to the learning styles of Indian children as they applied to implications for education of culturally different Indian children attending Indian schools. Utilizing the Visual Recall Ability Indicator, data were collected from 3,344 Indian students (ages 8-16) drawn from 18 reservation schools of the Navajo, Hopi, and Jicarilla Apache tribes, and from 797 Caucasian students drawn from 9 schools in the urban communities adjacent to the reservations (Farmington and Grants, New Mexico and Page, Arizona). Among the findings were that Indian boys and girls surpassed Caucasian boys and girls, and the Hopi students exceeded the performance of the Navajos and Apaches at the .05 level of confidence. The practical significance of the results was that the Indian sample population differs significantly from the Caucasian sample population in the basic cognitive strengths each population brings to formal schooling even though there may be differences in performance levels among the tribal groups tested. (Author/NQ)

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VISUAL PERCEPTION AND RECALL OF SCHOOL-AGE NAVAJO, HOPI,
JICARILLA APACHE, AND CAUCASIAN CHILDREN OF THE SOUTHWEST

including

RESULTS FROM A PILOT STUDY AMONG ESKIMOS AND
ATHABASCAN SCHOOL-AGE CHILDREN OF NORTH ALASKA

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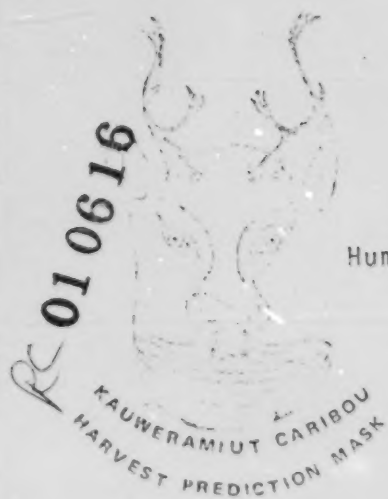
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Dr. Laurel L. Bland
1921 W. 17th
Kennewick, WA 99336

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Seven years have passed from the genesis of the idea for this research to the completion of this report. It began with a pilot study in the Alaskan arctic and with the support and encouragement of many people from many walks of life, came to fruition in the deserts of the Southwest. I cannot acknowledge individually all of the people who contributed to this effort, but the few mentioned will hopefully represent them all. Five people gave the greatest impetus needed to begin. Barbara Trigg, my dear friend and an officer then of the Arctic Native Brotherhood who said "You must do it.", and her mother Nellie, who said "You can do it."; William Oquilluk, my beloved teacher, who said as we struggled to turn his collection of sixty years notes into an English documentation of the Oral Tradition of his ancestors into People of Kauwerak, "Things must be written down if understanding is to come to our children and their children."; and my two mentors, Dean Wendell Wolfe of the University of Alaska who has advised me since 1966, and Professor Robert Fredericks of Alaska Methodist University who has been a mentor since I began college teaching in 1970, both of whom agreed this study should be done.

In New Mexico, this research could not have been accomplished without the remarkable cooperation and support of the Navajo, Hopi, and Jicarilla Tribes, officials and administrators of the Bureau of Indian Affairs, school administrators, teachers, and students, and my understanding and highly supportive dissertation committee. Of these, I should like to particularly acknowledge the help of Ms. Faralie Spell and Richard Jonas of the Bureau, and Drs. Louis Rososco, Paul Resta, Richard Tonigan, and Miles Zintz of the University of New Mexico.

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Family and closest friends are always affected in an effort such as this. I wish to publicly express my appreciation to mine -- particularly to my son, Daniel, who arranged to work on his graduate studies at a nearby university "just in case, Mother. . .", and Lew McFerren who sent care packages of frozen salmon, king crab, and moose from Alaska "to keep up your spirits", to a displaced and sometimes homesick Alaskan.

If it were proper to dedicate a thesis, I would dedicate mine as evidence that the older generation does live up to the ideals taught in our schools, to the children and grandchildren of people like Jerome Trigg, Martin Olson, Teresa Soolik, William Oquilluk, Donald Peter, Nettie Peratrovich, Hannah Schnare, Harry Carter, Elaine Ramos, Velma Garcia, Andrew Pete, Delbert Monanni, and my own grandsons, Scott D. J., and Christopher Lee Eisinger. For, in the words of my daughter, as president of her college graduating class:

" . . . we do not leave this life with either a 'band' or a 'whimper', we can only hope to contribute along the way to our understanding of each other."
 (Laurel Kathleen Bland, Commencement Address, University of Alaska, 1965).

Any errors or omissions in this research are, of course, my own.

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ABSTRACT

VISUAL PERCEPTION AND RECALL OF SCHOOL-AGE NAVAJO, HOPI, JICARILLA APACHE, AND CAUCASIAN CHILDREN OF THE SOUTHWEST

Laurel Le Mieux Bland, Ph.D.
Department of Educational Foundations
College of Education
The University of New Mexico, 1975

It is a matter of public record that the present system for educating Indian children attending de facto segregated Indian schools has failed to serve Indian schoolchildrens' needs as evidenced by low academic achievement levels, accelerating over-age in grade level, and high drop-out rates. This may be due in part to lack of knowledge regarding the cognitive strengths and learning styles of Indian children, although much appears in the literature regarding their weaknesses as associated with school readiness and academic accomplishment. This study attacks the problem by attempting to determine if a significant difference is demonstrated between Indian and Caucasian population samples on visual perception and recall tasks associated with cognitive function in keeping with two general hypotheses.

1. There is a significant difference between scores obtained by Indian children enrolled in Indian reservation or community schools and that of Caucasian children enrolled in public schools of adjacent non-reservation urban communities when measured by the Visual Recall Ability Indicator.
2. There is a significant difference between children from the different Indian Tribes in scores obtained using the Visual Recall Ability Indicator.

The purpose is to relate any demonstrated difference to the learning styles of Indian children as they may apply to implications

for education of culturally different Indian children attending Indian schools. This study involves samples from two culturally different populations of schoolchildren, American Indians and Caucasians of the Southwestern United States. Indian subjects are drawn from reservation schools of three tribes, 2,627 Navajo, 472 Hopi, and 245 Jicarilla Apache for a total of 3,344 subjects representing 24 percent of the estimated 1973-74 on-reservation school enrollment of children from the ages eight through sixteen. For identical ages, 797 Caucasian schoolchildren were drawn as subjects from three urban communities adjacent to the reservations of the Indian sample population. The Caucasian population sample includes 396 subjects from Farmington, New Mexico; 160 subjects from Grants, New Mexico, and 241 subjects from Page, Arizona; representing 14 percent of the estimated 1973-74 Caucasian school enrollment for these municipalities.

Instrumental strategies involved collecting data in ordinary classrooms of eighteen Indian reservation schools and three schools of each of the Caucasian communities. Data collection utilized the Visual Recall Ability Indicator, specifically developed for measuring visual perception and recall abilities among American schoolchildren in this and a similar study in Alaska. This device is adapted from test items used in the Bender Visual Motor Gestalt Test and notes a $r = .89$ reliability for five independent raters.

Results of statistical treatment of the data using one-way analysis of variance, open H's, $p = >.05$ for one-side t-test to test a series of twenty-four null hypotheses are reported noting the Indian sample exceeding the Caucasian sample on all aspects tested. Using a two-side t-test at the $p > .001$ level of confidence, Indian boys surpassed Caucasian boys, Indian girls surpassed Caucasian girls,

and the Indian subjects surpassed the Caucasian subjects. The Hopi subjects exceeded the performance of the Navajos and Apaches at the .05 level of confidence. The practical significance of these results are that the Indian sample population differs significantly from the Caucasian sample population in the basic cognitive strengths each population brings to formal schooling even though there may be differences in performance levels among the tribal groups tested.

Chapter 1

STATEMENT OF HYPOTHESES and BACKGROUND FOR THE STUDY

There is ample evidence to indicate that culture clearly affects the visual perception and learning styles of schoolchildren. There is little research, however, on what the affects of these cultural differences may be regarding the visual perception and learning styles of the culturally different child in American schools. Within recent years there has been a growing recognition that new curricula and learning strategies are needed for the non-majority culture child. The development of such strategies and materials will require a substantial research base to determine specifically the similarities and differences between majority and minority culture children.

The American Indian child has been one of the most educationally neglected individuals within the United States educational system. Too often these children have been forced to learn concepts in a language that is foreign to them. In addition, the curriculum content has been largely alien or unfamiliar to them, and the instructional methods have frequently been at variance with their own culture. What has been done thus far has been to incorporate their own culture into the Indian child's learning experience. Even less has been done to determine the differences in cognitive styles and visual perception that may relate to effective learning for Indian students. This

study addresses itself to the general hypothesis that:

Descendents of American aboriginal people living in Indian communities demonstrate significantly greater abilities in visual perception and recall tasks than do Caucasians from typical middle-class American communities that can be measured and compared.

Background for the Study

Research in education finds much of its purpose and justification to the degree that results of research may enable schools to meet national and local academic achievement standards. In the broad sense this requires constant testing, measuring, and evaluation of the nation's schools in order to insure the sum total of each school generation will meet the predicted needs of a dynamic, highly technological society. Educators, however, in principle strive to meet educational goals through meeting local school community needs and expectations. In this context, descriptive labels have been assigned to vast numbers of schoolchildren now given special attention under classifications like socioeconomically disadvantaged, handicapped learners, and the culturally different. These labels are commonly applied to children who fall within the normal range of human intellectual ability but fail to achieve established norms for academic skill levels. (Exceptional children, whether they are abnormally bright or mentally retarded are a special class of schoolchildren, and not included within the scope of this discussion.) Each of the three classes of schoolchildren named have common patterns of low academic achievement, high dropout rates, and subsequent social and/or economic maladjustment as adults. As is implied by the labels, equally common causal factors contributing to the patterns can be

described for disadvantaged, learning handicapped, and culturally different children, as well as specific conditions peculiar to each group. These general causal factors are generally known and recognized by educators and the interested public. The classification of Indian children used in this study is culturally different, although there is basis to include aspects of both socioeconomic disadvantage and handicapped learning as internal components of any comprehensive description of the ills besetting Indian schoolchildren in Indian schools (Kennedy 1969).

Culturally different is usually applied to Spanish Americans, Puerto Ricans, Chinese Americans, Japanese Americans, American Indians, Eskimos, Aleuts, and others who are seen through the eyes of the public to be insular groups largely composed of non-English speakers and ascribing to special customs not shared by the majority of middle-class Americans. American Indians (including Eskimos and Aleuts of Alaska) are given particular recognition as culturally different through Federal laws establishing them as a special class of citizens with tribal governing rights that in some instances supersede the powers of the states holding tribal lands. Historically, beginning with their aboriginal status and throughout westward expansion and nation-wide industrialization, American Indians have been isolated and insulated from general westernization and urban living. Thus, whether by their own choice or by Federal Treaty, it is clear that American Indians are culturally and legally different from other groups classed as culturally different. Regardless of why this has occurred, between one-quarter and one-half million

Indian children attend schools with virtually exclusive Indian enrollment being conducted much like urban middle-class schools; yet little is known about the cognitive development of these culturally different children.

Whether or not differences in demonstration of specific levels of skills associated with mental abilities will occur between Caucasians and Indian children is yet to be demonstrated. Most mental ability measurements for Indian children reported to date emphasize either academic skills, developmental task accomplishment, or psychosociological inventories. An assumption of this study rests upon a belief that Indian children bring different cognitive strengths and weaknesses to the classroom than do Caucasian middle-class children. Schools serving Indian children cannot be expected to respond effectively to the needs of Indian students until these strengths and weaknesses are known. Since virtually no research has been reported regarding specific investigation into Indian childrens' cognitive skill development, it seems reasonable to begin with one area where there is agreement that some difference appears to exist. This is in visual perception and recall as a cognitive function. Valuable information is likely to be gained from a comparison of appropriate task performance in this modality between Indian and Caucasian schoolchildren who share a common ecological environment and pattern of formal education including curriculum.

Failure of schools serving Indian communities to meet the needs of students with learning strategies enabling them to achieve academic norms became public knowledge in 1970. At that time, cause was primarily attributed to the delivery system (Kennedy 1969), and cultural differences (Zintz 1969). As educators responded to the Federal

Government mandate to upgrade and improve Indian schools. Speculation began to appear in the literature that a third and perhaps more basic cause may account in part for Indian children's failure to achieve in school. Educators began to articulate the possibility that Indian children may bring to the classroom different styles of learning -- different ways of applying universal forms of cognition incompatible with established general public school methodology (John 1972).

In order to develop more powerful and effective teaching strategies for Indian children, more complete information is needed on the cognitive styles and visual perceptual abilities of Indian children. For example, if Indian children are found to enter school with a more highly developed ability in one area or in one sensory modality than Caucasians, it is an area of strength from which to expand in structuring learning related to acquiring academic proficiencies. Equally important, if substantive research suggests a significant number of Indian children demonstrate differences in visual perception and recall, this may lead to the development and implementation of appropriate educational strategies to direct this strength toward acquiring academic competencies. If no difference is found, this may suggest that the strategies incorporated in present learning materials may be adequate in this aspect of cognitive function. However, if no difference is demonstrated in visual perception and recall skill, it does not mean there is no other aspect of learning style without difference or that curricular content is appropriate and does not need modification.

Pilot Study

The hypothesis stated earlier was suggested by a pilot study involving Alaskan Native and Caucasian children. In 1968 the researcher was engaged in the initial stages of validating an instrument designed for clinical use to diagnose neural impairments to reading for use as a group test instrument. The purpose was to adapt instrumentation so the device could be used as a rapid screening tool by classroom teachers enabling them to identify students to be referred for remedial support being provided by the schools. Unexpected results from this effort led to the subsequent use of the instrument for an entirely different purpose.

Validation procedures for the clinical instrument took place in classes with a high enrollment of Alaskan Eskimo and Indian children. It was found that these children consistently obtained significantly higher scores on the instrument than did their Caucasian classmates.

After reviewing the scores obtained by the groups of Alaskan Native subjects, persons associated with the validation project concluded the instrument was potentially valid and reliable for conducting comparative studies in visual perception and recall ability between culturally different school populations. Recognizing the possible implications for education of Alaskan Native children inherent in determining whether they do in fact have higher levels of skill in visual perception and recall than do Caucasian children of equivalent ages, it was decided to design and execute a small pilot study.

Subsequently, the instrument referred to earlier was employed in an independent pilot study conducted under the guidance of Dr. Troy Sullivan, Education Division of the Senior College, University of Alaska-Anchorage. The study involved remote Alaskan Native villages and two urban Caucasian communities.

As a part of the pilot study an effort was made to determine inter-rater reliability in scoring one-hundred protocols. To obtain a gross estimate of reliability, two independent raters scored one-hundred randomly selected protocols from samples taken during the study. Inter-rater reliability was demonstrated at $r = .83$. This small reliability check was performed due to the fact no reliability information was available for the instrument when used with groups rather than individuals, and this was seen as a prudent precaution under the circumstances.

The results of the pilot study suggested that among the groups tested, Eskimo children demonstrated higher levels of skill in visual perception and recall on the instrument used than did the Caucasian children (.01 level of confidence). Similarly, the Athabascan Indian children appeared to demonstrate a higher level of skill than the Caucasian sample (.05 level of confidence). It is also noted that the study suggests there was no significant difference between the scores obtained by the Eskimo and Athabascan Indian children (Bland 1970).

The pilot study and its implications for the education of Indian children lends support to the opinion that this type of cross-cultural research in education may prove fruitful in pursuing efforts

to determine (1) if all insular Indian tribal groups exhibit similar basic differences, and (2) if the difference suggested in the pilot study may be peculiar to descendants of aboriginal Eskimos and Alaskan Athabascan Indians. If American Indian children of tribal groups in the contiguous states reflect the same differences found in the pilot study, the results become of major interest to those involved in Indian education programming at the Federal level, and may contribute substantially in the effort to improve Indian children's academic achievement and skills proficiencies. If the difference appears to be confined to Alaskan Native children, it becomes a concern of local education planners; but the information may also open avenues of inquiry associated with other disciplines more directly concerned with human behavior and evolution.

In light of the foregoing, a more careful and comprehensive replication of the pilot study under rigorous research conditions appeared both reasonable and justified. Thus, the present study represents such an effort to determine the differences, if any, within Indian groups and between Indian and majority culture children of the Four Corners region of the Southwest.

Accordingly, the broad hypothesis as stated on page 2 regarding differences in visual perception and recall between American Indians and Caucasians was limited and refined to a more appropriate statement upon which to base the research design and appears on page 10 in the section of this chapter dealing with the research hypotheses.

General Research Design

In order to test the general hypotheses regarding a difference, if any, to be demonstrated between Indian and Caucasian school children in tasks associated with visual perception and recall, a suitable measuring instrument is required. It must provide individual scores obtained through group testing describing levels of accuracy in performance of such tasks by children of different cultures who presently attend schools with similar curricula located in the same geographic region. Data obtained from the instrument must be suitable for statistical treatment, thoughtful interpretation on the basis of empirical evidence, and founded upon theoretical assumptions believed to be generally acceptable in educational research.

No commercially available standardized instruments among those reviewed for this study were judged superior to a refined and more rigidly controlled version of the device used in the pilot study by Bland (1970). This instrument, therefore, was adapted for the purposes of this study (see Addendum A) under the title, Visual Recall Ability Indicator (VRAI).

Groups of subjects for the study were chosen on the basis of shared commonalities of regional residence, natural environment, base-line economy, size of school enrollments, population characteristics of school enrollments, and similar grade level academic achievement requirements for matriculating students.

Due to the recognized disparity between Indian and Caucasian children as regards rate of grade progression when compared to

chronological age, it was judged more appropriate to report data in terms of chronological age rather than grade level.

Data collected represents samples from the largest concentrated Indian population in the United States, subdivided by sample units into population samples for the three largest tribal populations within this total Indian population. These are the Navajo, Hopi, and Jicarilla Apache Tribes of New Mexico and Arizona. Caucasian sample units were obtained from communities meeting general criteria for all subjects as regards factors of residence, economic, school enrollment, school population, and academic task accomplishment. These criteria were designed to compare data obtained from two culturally different school populations reasonably equal on the basis of shared commonalities in so far as appears possible.

Research Hypotheses

With the foregoing qualifications, the populations were sampled on the basis of two general research hypotheses:

1. There is a significant difference between scores obtained by Indian children enrolled in Indian reservation or community schools and that of Caucasian children enrolled in public schools of adjacent non-reservation urban communities when measured by the Visual Recall Ability Indicator.
2. There is a significant difference between children from the different Indian Tribes in scores obtained using the Visual Recall Ability Indicator.

In order to subject the above general hypotheses to statistical tests a series of twenty-four specific statements in null form were developed. For the sake of brevity, these are reduced to twelve abbreviated statements conforming to the twenty-four reported in Chapter 5.

1. There is no significant difference between the mean scores for all test items for the Indian subjects and those for the Caucasian subjects.
2. There is no significant difference between the mean score for Indian boys and that for Indian girls.
3. There is no significant difference between the mean score for Indian boys and girls ages 8-10, 11-13, and 14-16 years.
4. There is no significant difference between the mean score for Hopi subjects and that for Navajos, Hopis or Jicarilla Apaches, or Navajos and Jicarilla Apaches.
5. There is no significant difference between the mean score for Caucasian boys and that for Caucasian girls.
6. There is no significant difference between the mean score for Caucasian boys and girls ages 8-10, 11-13, and 14-16 years.
7. There is no significant difference between the mean score for Caucasian subjects of Grants, Farmington (New Mexico), and Page (Arizona) public schools.
8. There is no significant difference between the mean score for Indian boys and that for Caucasian boys.
9. There is no significant difference between the mean score for Indian boys and that for Caucasian boys ages 8-10, 11-13, and 14-16 years.
10. There is no significant difference between the mean score for Indian girls and that for Caucasian girls.
11. There is no significant difference between the mean score for Indian girls and that for Caucasian girls ages 8-10, 11-13, and 14-16 years.
12. There is no significant difference between the mean scores for test items #1, #2, or #3 between Indian subjects and Caucasian subjects.

Statistical Treatment

As recommended by Popham (1967), data was recorded for treatment by a statistical model using one-way analysis of variance, open N's,

using F ratio and one-side t-test at the $p > .05$ level of confidence to accept or reject the hypotheses as stated above.

Chapter 2

A SURVEY OF LITERATURE

This survey of literature includes a representative collection of opinion related to this study. Authors and reports are cited in associative context in ways that directly bear upon the concerns of this study. This selection of literature is intended to serve several purposes in relation to a cross-cultural investigation of visual perception and recall as it may relate to the learning styles of Indian children from selected contemporary tribes of the Southwest United States. Opinions cited afford (1) the basis for theoretical presumptions regarding visual perception and recall as a function of cognition both in general terms and as it relates specifically to Indian childrens' learning styles (Webster 1973, p. 272); (2) development of a background for interpreting or explaining results of this study; and (3) development of a rationale for research and instrumentation strategies used in the design and execution of this investigation.

The terms visual perception and recall in context with cognition appear to vary little across the disciplines of anthropology, education, or psychology. There appears to be general agreement with the theoretical and definitive treatment appearing throughout the references cited. Cognition and learning styles among Indians are treated predominantly by reports related to

psycho-sociological interpretations based upon factual or anecdotal observation. Only three references were found dealing specifically with controlled research regarding visual perception and recall across cultures. All are recent: one in Canada (Annis 1974), one in Alaska (Bland 1970), and one in Israel (Kugelmass 1972). These

Every reasonable effort has been directed toward providing a representative selection of opinion and investigation appearing in the literature surveyed in support of this study.

Technical and theoretical definitions for visual perception and recall appearing here depend heavily upon the work of Appel, Arnheim, Ellis, Wohlwill, and authorities appearing in the Encyclopedia of Education (1971).

General Theories of Visual Perception and Recall

Wohlwill (1965) in "The Definition and Analysis of Perceptual Learning" postulates that perceptual learning is "the development of a generalization of a previously established differential response to a new stimulus. Thus defined, perceptual learning does not require the formation of new S-R associations, and in contrast to associative learning, may occur in the absence of external reinforcement."

Appel et. al. (1969) in "The Development of the Distinction between Perceiving and Memorizing" and Ellis (1972) in Fundamentals of Human Learning and Cognition further refine this concept in relation to learning through visual perception.

with subsequent encoding, storage, and retrieval of information. Ellis (1972, pp. 201-206) provides a content description of the application of Gestalt theory in visual perceptive learning. Visual perception and motor skills learning are seen to be a twined largely unconscious mental process whereby the brain serves as the "computer" developing its own programming for learning that may serve for an individual lifetime with very little or no change. When such a system for learning proves satisfactory during an individual's formative years, it is likely to remain the primary, preferred, and permanent method by which that person gains, stores, and retrieves knowledge and information (Ellis 1972, p. 5, p. 83). This theory, as described by Ellis, accepts the vital role of recall through visual imagery applied in the process for information retrieval described by Appel et al. (1960, pp. 165-72).

A strong distinction is made between memorizing, as a rote response, and recall of desired information through visual imagery which is seen as a discrete mental function. The basic distinction views memory as an automatic stimulus-response, while recall through the little understood process of visual image retrieval is a sub-system of cognitive function (Appel et al. 1969, pp. 170-172). The theoretical framework for this study rests upon information-processing approaches to theorizing about the various ways learning processes may occur and become permanently established among people of Indian cultures. This strategy assumes

agreement with generally accepted psychological theory, since, in the words of Ellis:

Three theoretical approaches have been developed in accounting for the events of thinking and problem solving. In general, theories of thinking and problem solving are less formal than are theories of the less complex processes of human learning. One class of theories involves the extension of stimulus-response associationistic conceptions to the processes of *thinking and problem solving*. This class of theories is very similar to stimulus-response theories of concept learning and adopts the same fundamental assumptions. A second class of theories stems from Gestalt psychology and has emphasized the importance of insight in problem solving. This class of theories views thinking and problem solving as a matter of reorganizing one's perceptual world. Finally, a third class of theories use information-processing conceptions to understand thinking and problem solving (Ellis 1971, p. 184).

According to Bevan (1958, p. 1362) in "Perception: Evolution of a Concept," information storage and retrieval through visual perception and recall appears to be a universal function whereby it becomes an "interactive stimulus input-receptor function with motivation and past stimulation properties." The importance and extent the role this particular form of cognition plays in the whole process of learning function is not yet known, but there is growing agreement among psychologists that it is of significance (Ellis 1972, pp. 5-83). The extent and degree to which the individual relies upon visual perception and recall in the overall learning process is largely dependent upon its proven functional value during the developmental task accomplishment phases of early childhood (Havighurst 1952, pp. 4-28).

Hunt (1971, vol. 3, pp. 178-80) states perception is a cognitive input after infancy, but starts in very early childhood

when it begins to occur as a lifelong process of sequential action of stimulus-stimulus. In this fashion, it is the means where one action leads to another such as hand-eye coordination. It is the paired responses of observation and recall with hand-eye coordination in reproducing test items that forms the basis for most instruments designed to measure visual perception and recall.

Segal (1971, vol. 5, pp. 457-65) states it has been amply demonstrated empirically that children and adults of different societies are subject to different visual illusions. In The Influence of Culture on Visual Perception, Segal (1966) describes in detail the research leading to his conclusion that children being tested for functionality of responses in problem solving situations perform to the degree the skills are utilized in their society. It is believed these are learned as appropriate and functional mental abilities developmentally incorporated into the lifetime fundamental framework utilized in cognition. Development of this foundation for cognition is seen to be determined by, and in accordance with, the "real world as perceived by the child's society." The extent to which visual perception and recall can affect learning is found in the conclusion that people are subject to optical illusions to the correlation of the "degree of rectangularity" found in their environment (Segal 1971).

Pribram (1971, vol. 1 pp. 482-485) finds experimental studies show memory of what is visually perceived is progressively discriminatory and differential -- that is, it is a process of discriminatory learning. He describes visual perception as a process,

not an achievement or a product, and notes visual imagery is one method of recalling information encoded through the process of perception. Epstein (1971, vol. 9 pp. 445-460) expands upon this concept to explain the eye serves as the extractor of information, as the selector of what to "see", the comparator of "what it is", and the recorder for memory banks. "This process serves to select and differentiate, compare with previous memories, and aids in the assessment in the assumptive context for language programming."

In a definitive text, Visual Thinking, Arnheim (1969) ranges from early Greek philosophers to contemporary psychologists by tracing theories through time regarding visual perception and recall as functions of cognition. Arnheim contends scientific methodology emphasizes observable behaviors in the formulation of learning theories--particularly demonstration of verbal and reading proficiencies. This emphasis, he believes, tends to overlook a highly complex developmental process he refers to as the "intelligence of perception." In a chapter of this title, Arnheim indicates he regards visual perception and recall (including imagery) as the keystone in developing "thinking" abilities and argues this logically progresses with increasing skill in cognition to a plateau where "images of thought" are regarded a phenomena of the highest levels of abstract and symbolic thinking. He strongly implies that skills associated with visual perception and recall may be underdeveloped among many populations due to early emphasis upon learning verbal, reading, and writing skills. He quotes from Holt (1964) in a paper titled "Imagery: The Return of the Ostracized":

A faint subjective representation of a sensation or perception without an adequate sensory input, present in waking consciousness as part of an act of thought includes memory images and imagination images; may be visual, auditory, or of any other sensory modality, and also purely verbal. (Arnheim 1971, p.99).

Arnheim then goes on to state: "The capacity of the mind to raise parts of a memory trace above the threshold of visibility helps to respond to the question: How can conceptual thinking rely on imagery if the individuality of images interferes with the generality of thought? The first answer is that mental images admit of selectivity. The thinker can focus on what is relevant and dismiss from visibility what is not." Noting that this is still a crude definition of abstraction, he then postulates images may be "particular and at the same time generic" serving some individuals as a vast mental dictionary, taxonomy, and reference library all in this single mode of cognitive function (Arnheim 1971, pp. 105-107).

Arnheim (1971, p. 107) draws upon Tichener (1909) in Lectures on the Experimental Psychology of the Thought-Process who referred to his own mind as a "fairly complete picture gallery -- not of finished paintings, but of impressionist notes", and continues to describe how the printed word calls forth certain generic visual images for abstract concepts like "courtesy, humility, pride, gravity, modesty, or stateliness." This example Arnheim uses to illustrate it is no longer popular to admit to anything as unavailable to scientific measurement as a function of intellect relying upon visual recall or imagery as a primary strategy in thinking or problem solving. The statement may be overly strong in view of other literature cited herein, but it does serve to

point out the function of visual recall is difficult to define, little understood, and can only be measured or demonstrated by inferential methods. The import of Arnheim's writing in both Visual Thinking (1971) and Art and Visual Perception (1971) is that one cannot think without images, that visual perception and recall are integral parts of learning and cognition, and visual recall persists throughout all levels of thinking to the highest degree of abstract and symbolic cognition.

Support for Arnheim's position is found in such widely divergent points of view as those typified by Ellis who says when referring to visual perception:

Perceptual learning refers to changes in perception that can be brought about by learning. Although there is somewhat less agreement about the concept of perception than there is about the concept of learning, perceptual learning can be easily understood in functional terms.

.....
Perceptual learning focuses attention on the properties of stimuli as important determinants of learning. (1971, p. 168).

And, Pastore (1960, p. 93) who states that:

All the significant aspects of perceiving are unlearned. These include pattern and depth perceptions, the so-called laws of organization, figure-ground relationship, solidity, the illusions, the constancies, the phi phenomenon, figural after-effects, and the perception of the world as upright.

Goodenough (1971) describes the cyclic evolutionary process in the genesis and development of a language. Visual perception is culturally determined; as part of the cognitive process it helps to shape the language. As visual perception

shapes language, the language itself not only affects/modes of thinking, but describes and defines the role visual perception may play in cognition.

Classic studies to determine the onset of visual perception and recall as cognition are frequently associated with E.J. and J.J. Gibson (Gibson and Gibson 1955, Gibson and Walk 1956, Gibson and Walk 1960, Gibson, Walk, and Tinghe 1959). E.J. Gibson (1961) in a perception study related to the development of perceptual skills related to reading readiness in children aged four through eight years, offers conclusions pertinent to developmental aspects regarding measurement of visual perception and recall. Indications are that differentiation between nearly identical geometric or cursive forms takes place by age four. Association necessary for recall appears to be fully established by age eight. Gibson concludes "Unequivocal referential meaning...must be learned; it is not given in the stimulus emanating from them" (items used in visual perception and recall tests).

In the broadest sense, some authorities argue the viability of a cultural life-style may be determined by the functional role perception plays in cognition both for individuals and the society as a group. Spindler and Spindler clearly reflect this point of view.

What has already been said about the stability, sometimes dysfunctional stability, of psychological structure in culture change situations, suggests the determinant role of personality as a selective, perceptual screen. In the absence of clearcut and meaningful rewards for psychological readaptation, the psychological structure based upon survival of attenuated traditional culture will block out whole areas of the new cultural environment and makes white culture as necessary accessories to getting along in today's world. (Spindler and Spindler 1972).

Implications for Learning Theory

The hypotheses being tested in this study relate to demonstrations of visual perception and recall abilities. Rationale for undertaking the investigation rests in the merit it may have in relating findings to the learning styles of Indian children. Popular opinion among social scientists and teachers working with Indian people reflects a widespread belief that Indians, particularly children, have exceptional visual perception and recall abilities. This is frequently mentioned in the literature. Rationale for assigning importance, not value judgement, to any demonstrable difference in mental abilities between cultures and subcultures rests in possible implications the differences may hold for those who apply learning theory in the development of education for persons in cultures where differences may exist. This survey of literature, in view of the paucity of reports dealing with empirical studies among Indian children exclusively designed to measure visual perception and recall, turns instead to development of a foundation leading to a reasonable interpretation of the data collected in this study.

Kneller (1966) in Educational Anthropology, examines educational philosophies relative to education for disadvantaged and culturally different children. Both progressive and conservative views in American education agree that humanitarian, social, and economic considerations mandate special attention to the needs of children from minority backgrounds. Progressive and conservative educators, however, do differ in how those needs should be met through curriculum and instruction. Considerable resistance may be encountered in both

views toward research tending to establish a special class of people to be educated upon the basis of mental abilities different from those demonstrated by the majority. Both philosophies do permit room for cross-cultural educational research, but indications are that those based upon statistical analysis and careful explanation will be more acceptable than those based upon less empirical evidence (Kneller 1966, pp. 116-152).

As typified by Havighurst (1972), most authorities agree that an individual's learning process is strongly influenced by cultural values and practices. This process, in fact, may be dictated by cultural determinants acting upon individual members of a small society, although this has not yet been empirically established. Most authors cited in the following pages seem to agree that learning theories as interpreted and applied in American urban public schools may require a different interpretation when used as the foundation for educating Indian children. Although few of the studies cited are concerned with visual perception and recall as they relate to educational theory, in substance they concern learning function. Thus, together they illuminate the need for greater awareness and understanding of the ways Indian children may marshal their mental abilities to cope with the demands made upon them by the ordinary class-room experience.

Spradley (1972, pp. 3-35) states in his introduction to Culture and Cognition, that the learning and development of symbolic thought among people follow different paths resulting in different "cognitive maps" best fitted to the needs of their culture and

society. Five rules generally affect what and how people learn from the seemingly infinite variety of factors that are believed to affect intellectual growth and development:

1. Rules are instructions to behave in a particular way.
2. Rules, as elements of human knowledge, have their locus in the mind.
3. Rules are learned through symbolic communication and by inference from behavior.
4. Rules are learned at different levels, which determine their effect upon behavior.
5. The rules inferred by an observer from the behavior of an actor are not isomorphic with the rules employed by that actor. (Spradley 1972, pp. 18-25):

Spradley concludes:

The customary behavior which occurs in each society results, in part, from the cultural knowledge learned by its members. While much of what we know comes through sensory experience, it is never identical with environmental objects. Information is transformed before it arises as percepts in the mind. Furthermore, as we select, abstract, and arrange the properties of objects to form concepts, our knowledge is even further removed from the empirical world. But most significant transformation comes when we employ objects and events to act as signs which refer to other phenomena, including those which have no physical reality. Symbols--those signs which are arbitrarily attached to referents--open up a myriad of possibilities for man.

Rules are like a program stored within the brain for construction, combining, interpreting, and otherwise dealing with symbols. In themselves they do not determine behavior, since human action results from processing a great deal of other information in addition to using rules. While it is impossible to formulate rules which are identical to those someone is using, a primary goal of cultural and cognition research is to decipher the codes and discover the tacit rules which each society uses to maintain its distinct symbolic world. (underline added) (Spradley 1972, pp. 33-35).

Support for the belief that descendants of aboriginal people of North America may generally share different "cognitive maps" is seen in the similarity of observations and conclusions

drawn in the far north by J.W. Berry (1966), L.L. Bland (1970), E.S. Carpenter (1955), R.C. Gagne (1968), R.A. King (1967), R.K. Nelson (1969) and W. Oswalt (1967), all of whom report observation of remarkable visual perception and recall abilities among Eskimos and Indians; and those of V. John (1971), Goodenough (1926), W. Dennis (1942), and Zintz (1969) remarking these same abilities among Indians of the Southwest. Havighurst (1969), in generalizing about all Indians, reports Indian children's scores on those parts of standard achievement and mental abilities tests measuring visual perception were consistently higher than national norms.

Several other northern studies similarly suggest a culturally tied difference between visual perception and recall abilities of Indians and Caucasians. These are briefly outlined as follows:

1. Circular Pencil Maze Test given to adults in Alaska who scored slightly above national norms (Kunce, Rankin, and Clement 1966).
2. Goldstein-Sheerer Cube Test given to children in Alaska who scored equally well with urban Caucasian children (Reich 1966).
3. A small group of Canadian Eskimo boys approximated norms on several standardized tests of perceptual abilities and exceeded the norm on one device (Vernon 1966).
4. With a slightly larger sample of both sexes, another Canadian study reported similar findings (MacArthur 1968).
5. In a study of mixed Alaska Natives (Eskimo, Aleut and Indian), forty-two subjects surpassed norms on the object assembly test of the Wechsler Adult Intelligence Test (Foster 1969).

Phillips (1972, p. 370-379) in a study of communication competence among Oregon Indian children, states their established ways of learning may be opposed to the school's expectations and procedures as one reason why they demonstrate poor academic performance and remain largely withdrawn from classroom interaction:

Zintz (1969) in his Education Across Cultures, draws upon many years' experience working with Southwest Indian education to state:

The differences that exist between all groups can no longer be attributed to innate intelligence...

.....
Education deals with children in culture, and serves the ends of a culture.

.....
In the problem of education across cultures, the whole concept of a causal approach to behavior is rooted in understanding the background out of which the individual emerged.

.....
It is recognized that whole classes of Indian boys and girls who lack language ability and reading skills may perform in art class better than average than whole classes of non-Indian boys and girls. They may compensate for their lack of certain skills in the classroom by developing keener powers of observation to be able to portray what they have seen in pictures instead of the English language. (Zintz 1969, p. 50, p. 51, p. 111)

Zintz's last statement is not intended to imply that Indian children lack communication skills in their own language or among members of their society, but does appear to mean it is possible these children may consciously draw upon their visual perception and recall abilities in the classroom as compensatorial support in school performance.

Mental Ability Tests and Indian Children

Reports of mental abilities testing among Indian children using still current standardized instruments are found as early as 1926. Goodenough (1926) and Dennis (1942) report results on the Goodenough Draw-A-Man test among Hopi children compared favorably with national norms. Reports appear periodically for other measurements, particularly the Grace Arthur Point Performance Scale, the Stanford Achievement Test, and the Wechsler Intelligence Scale, Children. On all portions of these tests dealing with academic achievement related to reading, verbal, and computational skills, Indian children universally and consistently score at levels significantly below national norms. However, Havighurst and Neugarten (1955) in a land-mark evaluation of Indian children's academic achievement, pointed out that Indian children performed as well or better on those portions of tests measuring visual perception and recall abilities. In quoting from studies by MacGrenor (1945), and Joseph, Rosamond, and Chesky (1949), Zintz (1969, p. 132) notes in these studies obtained from school children or others with some schooling among Indian tribes of the West and Southwest, mean scores on non-verbal tests of general intelligence (Goodenough Draw-A-Man and Grace Arthur Point Performance Scale) ranged from 102.5 to 115.5. In a recent report of a study conducted among Indian school children of an anonymous Northern Athabascan tribe, King (1967) reports "uniformly above average" scores were obtained on non-verbal portions of the California Test of Mental Maturity.

Zintz (1969, pp. 133-144), when discussing differences related to academic achievement levels among minority children, particularly those reported for the Southwest, points out that national statistics have changed little in forty years. As Indian children progress through the school grades, their achievement falls farther and farther behind and they increasingly become over-age in grade levels.

This phenomena is specifically illustrated by C.K. Ray (1962) in an Alaskan Native student school dropout study involving more than one hundred seventy public and BIA schools. For Alaskan Native students, steadily increasing chronological age accompanied by increasing over-age in grade levels, when combined with steadily decreasing academic achievement within grades showed a positive correlation with a steadily increasing dropout rate from the fourth through twelfth grades. "Cultural differences" appeared as the primary causal factor suggested.

John (1971, p. 333) states:

There is considerable agreement (then) on the part of social scientists, educators, and others that the Indian children of the Southwest are visual in their approaches to their world. Mrs. Anita Pfeiffer, principal of the Rough Rock Demonstration School, found her pupils precocious in their prereading skills. They display above average visual discrimination and fine motor coordination. Though research is limited, relevant to this observation, experienced early childhood teachers seem to concur with Mrs. Pfeiffer. (John 1971, p. 333).

The learning of Navajo children is described as one of exploration of their world "visually and by quiet, persistent exploration" whereby a style of instruction or demonstration of

learned skills "stress[ing] overt verbal performance is alien to such a child." Outside of their personal activities, Indian children well into adolescence frequently use gestures and touch to communicate, not words (John 1971, p. 138).

In more general theoretical terms, Segal (1971, vol 5 pp. 465-475) states that people perceive in a way that enhances accurate inferences about their environment. "Culture is a telegraphic means of labeling the things that affect group and individual behavior including language, economy, ecological environment, social and political structure, kinship customs, residence and settlement patterns, child rearing practices, and the dominant values and ideologies." Socialization and enculturation shape individual behavior, particularly in the acquisition of language. This in turn "shapes the terms whereby experience is coded, and thus reduces one's behavioral alternates by making certain modes of thinking more probable than others." Cultural variables in life style (subsistence or money economy; housing; beliefs reflecting physical, political, or social environment) all "affect the parameters of thinking." World wide studies have additionally demonstrated that culture influences visual perception. It may be presumed that "the ability to learn is produced by a complex interaction among diverse cultural forces." Some children use cognitive skills related to size or shape of objects, others by color or a label within their own language. It is not known how culture influences visual perception, but it is generally believed that differences in

cross-cultural test results indicating that this occurs "are culturally, not biologically induced." (Segal 1971, pp. 457-458).

Hill (1971, pp. 471-475) states cognitive theories of learning indicate that people learn according to their cultural belief in states of reality, that is, "the nature or strength of individual belief, expectations, and cognitive maps (phenomenal field)." This is explained as being "not the same as connectionist theories that explain learning solely as stimulus-response bond, habit, or conditioned response."

In relation to the development of cognitive maps by American Indian children, Henry's comment in "A Cross-Cultural Outline of Education" seems particularly appropriate. "We may speculate that very stable cultures have perfected or nearly perfected the process of narrowing the child's perceptual field--of training the child to dismiss from his mind anything not selected for his perceptions by the culture." (Henry 1960, p. 148).

Since the term culture has broad connotations, anthropologists sometimes use the term folk society to describe discrete tribal entities among aboriginal people of North America. Oswalt's definition may be properly applied to Navajo, Hopi and Jicarilla Apache tribal organization as well as divisions among the Eskimos and Northern Athabaskan Indians. Oswalt (1963) in a monograph on Alaskan Eskimos describes a folk society as "small, isolated, non- or semi-literate, homogeneous, highly integrated, and consensual, with strong group solidarity and simple division of labor." Cultural behavior is familial, traditional, and relatively static;

with highly personal relationships in the fundamental aspects of community order and business.

F.G. d'Aguill (1971, p. 210), in referring to "the genesis of culture" states:

....., although the cognitive matrix is a product of every individual's having been programmed or, in other words, of his having registered his life's experiences in terms of the formal possibilities for registering them that are built into the cognitive matrix.

A.F.C. Wallace (1951, pp. 735-756) states in an article "Individual Difference and Cultural Uniformities", that it is believed by anthropologists that any person with a problem will probably use some culturally recognized technique to solve it, but the freedom of choice will vary according to the number of systematic and random alternatives his culture affords for the solution of the problem, and the extent to which the given area of behavior is culturally standardized at all.

Cross-Cultural Visual Perception and Recall Studies

Three direct references to visual perception and recall ability testing across cultures were located for this survey. Bland (1970) reports a pilot study with significant differences demonstrated between Eskimo, Northern Athabaskan, and Caucasian children in Alaska. In a recently published report R.C. Annis (1973) reports a significant difference in the range of visual perception and recall between Cree Indians of Canada and urban Caucasians. Kugelmass (1972) reports finding a difference in the range of visual perception and recall in exploratory tasks between Israeli and

Bedouin children. In more general terms, G. Voyat and S. Silk (1970) report Pine Ridge Sioux children demonstrated the same levels of cognition in Piaget's developmental tasks as do their European and American peers.

The literature surveyed leaves little doubt that there does exist a real difference in the type and quality of learning readiness Caucasian and Indian children bring to their initial entrance into the classroom. Whether this difference is ascribed to academic behaviors, physical and mental health, or social interaction, it is generally loosely defined in the literature as "cultural difference". Some of the most highly respected authorities in American education such as Havighurst, state without equivocation that there is no innate difference in mental abilities between Indian and Caucasian children of equivalent ages (Havighurst 1957). The literature indicates that apparently by the time children reach the age to enter mandatory school they have developed suitable basic cognitive processes to deal effectively with the world around them. Presumably these include learning styles found suitable for coping with the developmental tasks imposed socially and culturally upon the individual child. It may then be safely presumed that the differences in successful school achievement between Indian and Caucasian children to date may be found to be associated in some way with well-established internalized learning processes developed before they enter school. These processes, according to the opinions being cited, very probably are associated with the known contrasting cultural traits associated with child raising practices in the two cultures. Caucasian children, it is

believed, are taught from early childhood through largely verbal direction from adults. Indian children learn through observation, self-directed exploration, and experience largely unsupervised by adults. In other words, it is common practice for Caucasian adults to explain everything they feel children should learn: while Indian adults apparently believe their children should learn for themselves.

A lengthy quotation from an article by John regarding the learning styles of Navajo children provides a succinct statement of these general ideas:

However, instruction in the native language by itself does not meet the need of closely meshing styles of learning with styles of teaching. A serious effort is needed to develop generalized knowledge concerning thought and language and to test such notions in work with Navajo children. Stereotyped approaches to thought are not limited to educators of Indian children. Indeed, most psychologists either avoid this area or are wedded to rather simple theories. Most educators and learning theorists assert that the use of language in thought is the only way man develops abstraction. On the other hand, an important approach to cognition, that of the Gestalt theorists, emphasizes perceptual processes. To them, problem solving is a rearrangement of relationships, and the term, "I see!" is just one example of the visual nature of cognition. The term "insight" is a further example of such orientation.

The paucity of tradition that characterizes the study of thought by psychologists (often relegating this topic to philosophers) may account for the limitations of extant approaches. In addition, behavioral scientists tend to choose their own cognitive processes, though unconsciously, as the basis for their theory building. The verbally brilliant Jerome Bruner has developed a model of cognitive growth that

culminates in a symbolic-verbal stage. In my own work, I have been partial to theories of thought that emphasize the pre-eminent role of language. But during the last couple of years, I have come to recognize the limitations of such approaches. Many factors, including my learning and teaching experiences on the Navajo reservation, have contributed to an interest in exploring the visual abstract as well as verbal processes of thought.

In an impressive series of experiments, William Pohwer (1969) has shown that verbal and visual processes were equally effective in children's elaborations of paired associate stimuli. If the process is an active, imaginative one, the child remembers what he has to learn many times better than when asked simply to link two words.

The long-standing emphasis upon language, as a dynamic inner process, rings introspectively true to many thinkers. However, some individuals rely on a visual flow of abstract imagery when hard at work on a new idea. (John 1972, pp. 340-341).

This section of a survey of the literature has presented opinion to establish the theoretical basis for defining visual perception and recall as linked cognitive functions having an intrinsic and vital role in an individual's learning process. It is not known how the function operates within the brain, but there appears little doubt that the process goes on. Indications are that the importance played by visual perception and recall through some form of imagery in individual learning processes or overall cognition may range from minor support to the primary mechanism. It is not known whether this role is determined by physiological (developmental) or psychological (cultural) determinants, or a combination of both. Whatever the determinants may be, it does appear that individuals and cultural or ethnic groups develop different skill

levels resulting in greater or lesser dependence upon visual perception and recall within the cognitive domain.

The foregoing is not intended to convey the notion that problems associated with education in Indian schools can be solved through discrete investigation of mental abilities. Strengths or weaknesses demonstrated by Indian children in abilities associated with the cognitive domain (like visual perception and recall) can provide strength in developing foundations for prescribing educational processes in Indian schools, but those processes must operate within the psychosociological conditions of the Indian child's life style. This situational affect is described dramatically by M.L. Wax as a condition that transcends Indian education concerns:

Given the abdication of their elders, and confronting teachers across a gulf of difference in age and culture, ...pupils organize themselves into a cohesive society. The school campus provides an essential locus for their meeting and activities, but the values of the school personnel are seldom their values. Some few educators do manage to work through the peer society to transmit some formal learning; however, most educators fight a continual battle just to maintain classroom discipline, and the turnover of new teachers is high.

Thus, in a basic sense, the problems....are not problems of "Indian education" so much as problems of "general education" in a society which requires the schools to be ethnic melting-pots and ladders of social mobility. (Wax et al. 1972, pp. 627-642).

Need for the Study

At the national level, the need for research leading to a better understanding about how and under what conditions Indian children learn most effectively is found in both humanitarian and economic concerns. The humanitarian rationale for an adequate

education is well established in the United States. The economic rationale for achieving uniformly adequate achievement norms in public schools is equally established; but becomes particularly significant in relation to Indian children. In part this is due to the explosive quality of the present Indian population where more than half its members are under age twenty (Kennedy 1969). The U.S. Department of Interior, Bureau of Indian Affairs (BIA) reports in Fiscal Year 1973 Statistics Concerning Indian Education (pp. 1-5) that 187,639 Indian children between the ages of five and eighteen enrolled with the various tribes were attending school, with an additional 8,639 not accounted for. These figures reflect only children identified as "Indian" by BIA records. Enrollment in tribes is determined by tribal authorities, and blood quantum or kinship-tie requirements vary from tribe to tribe. It is known an unspecified (and apparently unestimated) number of Indian children reside on and off reservations who are not included in BIA, public school, or tribal census records as "Indians". However, for the 1973 school year, more than 205,000 legally identified Indian children of school age are presently accounted for through these agencies.

For record keeping purposes the Federal Government has classified all direct descendants of aboriginal people of North America within its jurisdiction as "Indians" including the Eskimos and Aleuts of Alaska. Indian children from California, Idaho, Michigan, Minnesota, Nebraska, Oregon, Texas, Washington, and Wisconsin are educated solely through state public school systems. Of the remaining forty states, including those holding the largest concentrations

of Indian population, Indian children are educated through both federal and state systems. An estimated more than sixty percent of the children under BIA accountability do not attend BIA operated schools, although they do attend schools with virtually exclusive Indian enrollments. The BIA has assumed full responsibility for educating nearly sixty thousand Indian children in de facto segregated schools. The number of children in similarly segregated schools operated by state systems is not known, but an estimated 129,000 Indian children are presently accounted for in these systems, with an additional eleven thousand attending private denominational schools (BIA, FY 73).

The Indian Education Hearings of 1969 clearly establish that it would be misleading to assume Indian children enrolled in public school systems are not segregated in "Indian schools".

Alaska, Arizona, Montana, New Mexico and the Dakotas hold the largest Indian populations and are known to operate entire school districts within reservation or tribal boundaries. In these schools the entire non-Indian enrollment is seldom higher than one percent. Regardless of how Indian schools are administered, the low academic achievement levels and high dropout rates for all publicly funded Indian schools describes what was termed a "national tragedy" by the Federal Government in 1969 (Kennedy 1969). Presidential mandate in every administration since that time has directed national attention toward the need to remedy this situation. National policy in relation to Indian education has remained substantially

the same since President Lyndon B. Johnson's Message to Congress in 1968, when he stated in part:

The problems of Indian education are legion:
Standard schooling and vocational training
 will not be enough to overcome the educational
 difficulties of the Indians. More intensive and
 imaginative approaches are needed.

.....
 This is critical if the two-thirds of Indian
 school children in non-Indian public schools are
 to get the special help they need.

.....
 Indian youth must be given more opportunities
 to develop their talents fully and to pursue
 their ambitions free of arbitrary barriers to
 learning and employment. (U.S. President 1968)

Response among educators in relation to improving curriculum and instruction in Indian schools has centered primarily upon concerns associated with bicultural and bilingual education together with teaching English as a second language. Like John (1971, p. 341), a growing number of educators involved in Indian education are beginning to express doubt the whole answer for poor academic achievement among Indian children rests exclusively within educational domains, but in part may be found in basic cognitive processes peculiar to Indian children at this point in time.

The need to determine whether Indian children do, indeed, bring different cognitive processes to the schools gains importance in light of population statistics, in addition to those of academic performance. According to the BIA, in 1973, nearly forty-three percent of the Indian children were enrolled in the first four grades and kindergarten. Another more than four percent were enrolled in ungraded classrooms, these normally offering instruction up to fourth

grade when children then enter graded classrooms. Thus it appears in 1974 nearly half the Indian school children accounted for are presently enrolled in kindergarten through fifth grade. In contrast, less than seventeen hundred Indian students graduated from high school in 1973, a per capita decrease of nearly three hundred from the preceding year (BJA FY 73).

These figures, together with the common knowledge that more than half the Indian population is under age twenty, and the present birth rate remains high in relation to the nation as a whole, provide important humanitarian and economic reasons to conclude: If basic cognitive process differences do exist among Indian children, it is unquestionably vital knowledge to those who are responsible for developing and delivering formal education in Indian schools.

Instrumentation Strategies

Selection of an appropriate instrument to measure and compare visual perception and recall across cultures is dependent in this study upon two types of criteria: those established for valid and reliable instrumentation, and others having to do with the practical considerations of cost, simple and rapid administration, and requiring no special materials or equipment. A review in search of visual perception and recall tests and measurements depends primarily upon the Sixth and Seventh Mental Measurements Yearbook(s) (Roros 1965, 1972). A brief annotated listing of those instruments that appeared superficially appropriate for this study appears in Appendix B, together with notations indicating why they were not

selected. Virtually all tests evaluated in the Yearbooks represent adaptations of the Bender-Gestalt instrumentation.

Two non-standardized tests appear in the literature surveyed intended to specifically measure perception and visual recall. E. Gibson (1963, pp. 15-18) describes an instrument specially designed for her research in children's ability to discriminate graphic forms. The instrumentation requires a display board holding a model (standard item) with several rows of similar graphic forms appearing below the model. The perceptual task is to choose the single identical matching form among many that fit the model. Since the model remains on view, little visual recall (if any) is required. Like most visual perception and recall tests, this instrument is designed for laboratory use with a limited number of subjects being tested, one at a time.

Bland (1970) describes a test device in which the test items represent generally minor adaptations from those appearing in the Bender Visual Motor Gestalt Test; with the greatest departures in instrumentation occurring in test administration and scoring. The device used by Bland is labeled "The Squiggles Test" by its originator, Professor Vernon T. Edy of North Texas State University, who gave permission for its further adaptation in the Bland study. The Squiggles Test uses a series of progressively more difficult geometric forms as test items. It was designed as a simplified version of the Bender Visual Motor Gestalt Test to be used by reading therapy clinicians in the initial diagnosis of neural impairments related to visual perception, recall, and hand-eye coordination. It is also

recommended for classroom teacher use as a means of identifying children with academic performance problems who, on the strength of performance demonstrated on the test, may require remedial therapy or special education. The Squiggles Test was introduced in Alaska by Dr. Troy Sullivan of the University of Alaska and has subsequently been used in schools throughout the state for the past several years. In 1969 the instrument was pilot tested with classroom groups in view of its apparent success when used in the classroom with only one or two subjects and an examiner. Results of the pilot study indicated the instrument would apparently serve as a rapid screening device to identify subjects who might benefit from additional more controlled diagnostic evaluation on an individual basis (Gland 1969). Further validation of the Squiggles Test for diagnostic purposes under group administration has not been reported.

To date the Squiggles Test does not appear in the literature except as described by Bland (1970) and in two articles based upon the Bland study by J. Kleinfeld (1971a, 1971b). A mimeographed outline prepared by Dr. Sullivan of the University of Alaska (for use by his students) describing the Squiggles Test as a diagnostic test for reading difficulties appears in Appendix B.

Research Methods and Data Collection Across Cultures

D. Ary, L.C. Jacobs, and A. Razavieh (1972, pp. 190-212) in the standard text Introduction to Research in Education instruct those interested in performing quality research to choose an instrument to be used to measure mental abilities according to its capacity to

measure what it is supposed to measure in order to be valid; and it must be consistent in measuring whatever it measures in order to be reliable. They caution an instrument must represent the universe it intends to sample in accordance with the examiner's judgment, predict future performance, reflect current conditions, and rest upon a recognized theoretical foundation. These requirements are further discussed in detail as they relate to cross-cultural investigations. The authors note that cultural bias is still present in some comparative studies since "factual and narrative items vastly outnumber statistical analysis and careful explanation." Furthermore, most cross-cultural studies emphasize cultural values, child raising practices, attitudes and "general observable behavior relating to self-concept and identification."

D.B. Van Dalen (1973, p. 251) in Understanding Educational Research further elaborates upon these precautions and suggests cross-cultural research should confine itself to measurable behaviors deemed least subject to religious, socioeconomic, and cultural bias variables. J.W. Best (1970, p. 116) in his Research in Education, suggests cross-cultural research should confine itself to "relationships that exist" and that can be demonstrated in established ways.

In "The Growth of Intelligence from Birth to 18 Years: Consistency and Variability", Bayley (1971, p. 158) refers in part to research being conducted among the culturally different when she states:

...., it would seem well worthwhile to direct studies not only toward isolating but also toward

discovering the onset and course of development, of the different functions, or "factors" of intelligence. Furthermore, the tools with which we measure general intelligence should be fashioned with these considerations in mind. (Lee 1971, p. 36).

Mishler (1972, p. 269, p. 298) points out "Despite the enormous literature on learning, it would not be an unfair generalization to assert that how children actually learn what they do learn... remains very much a mystery. ... This requires a more systematic study in both field and laboratory setting, of the way in which children with different verbal and cognitive skills respond to different instructional styles."

The importance of cultural difference in learning is emphasized by anthropologist Hall's belief (1968, p. 5), "In the end a person's emotional stability is a function of his command of communication style that binds him to a human community with a history." (The implications related to learning theories in this statement are found in individual resistance to change in already established patterns of the learning process described by Ellis (1971, p. 4, p. 82)).

Mental Tests and Cultural Adaptations (Cronbach and Drenth, eds. 1973) provides discussion regarding the considerable attention that has been devoted to developing measures of intelligence or mental abilities for populations of non-literate or underdeveloped non-Western cultures. A catalog of culturally related variables that may affect research across or between cultures appears similar to considerations that have appeared in foregoing paragraphs by authors cited in this chapter. In general, comparative studies between

cultures are viewed as both weak and of questionable validity unless they are conducted for a specific purpose in relation to solving an extant problem such as educational programming. Validity then becomes a matter related to instrumentation and research design.

P.A. Schwartz (1972) devotes considerable attention to implications for research in other cultures in his report, Aptitude Tests for use in Developing Nations. He cautions recent international emphasis is placed upon measuring mental abilities related to cognitive process rather than attempting to measure "intelligence." Differences in performance behaviors can provide practical guidelines in programming to meet educational needs of culturally different populations. "These attach no value judgement regarding intellectual abilities based upon similar performance level comparisons across differing cultures."

According to Anastasi (1954, 1968) contemporary clinical test instruments used in measuring mental abilities associated with visual perception and recall as a function of intelligence commonly trace their origins to the now obsolete Benton Visual Retention Test and the still current classic, the Bender Visual Motor Gestalt Test. This has proved to be an effective device for measuring visual perception, recall, and hand-eye coordination independent of drawing ability, cultural origin, and age of subjects: although it has been found scores can be affected by educational levels of respondents. Anastasi (1954) points out that in measuring mental abilities among members of cultures other than those in which an instrument originates, when the results will

normally be stated in comparative terms, a device must be non-verbal and include the means for scoring suitable for statistical treatment as the basis for obtaining results.

Later reports support Anastasi's general admonitions, emphasizing the need to measure mental abilities by specific demonstration of single task proficiency from which appropriate inferences may be drawn. This is in opposition to tests which seek to establish intellectual ability upon the basis of knowledge about test items as is commonly found in academic achievement measurements. Cronbach (Cronbach and Drenth 1973) recommends that instruments used to collect data among sample populations from other cultures avoid timed and speed testing situations. Swartz (1972) further stipulates cross-cultural test instruments should avoid use of color or color definitions (except for special purposes associated with the study) since perception of color is known to be affected by culture. In some cultures color has psychosociological connotations that may affect test results. Frake (1972, pp. 191-205) further explains this concern in "The Ethnographic Study of Cognitive Systems" by pointing out test items using verbal labeling for culturally indigenous artifacts, flora or fauna, even in the native language, can produce invalid results due to the respondent's experience with the article. In some cultures certain words may only be spoken by adults or members of one sex, and a test item requiring these words even when communicated silently (as in pictures) is likely to bring an inappropriate response if they violate the subject's cultural conditioning or values.

On the basis of the literature cited in this section, recognized authorities in tests and mental measurements appear generally agreed that valid instruments for measuring visual perception and recall across cultures will use forms and designs in test items believed to be free from emotionally reactive stimuli for subjects, and use items seen to be equally familiar or unfamiliar. Test strategies should be non-verbal, impose no stress related to timed performance, and avoid test items or performances that have possible culturally connotative qualities for any one subject or group of subjects. Other considerations related to validity and reliability are those regarded as standard requirements for performing quality research. Among the several test instruments evaluated for this study, none appeared superior to the Squinole Test for this particular investigation in light of the criteria and practical limitations established for data collection. An added factor is the previous application in cross-cultural research under similar circumstances and the researcher's familiarity with the device.

Summary

After Havighurst (1957), the literature becomes less concerned with demonstration and comparison studies regarding Indian "intelligence" and emphasizes sociopsychological implications for in-school behaviors. Indications are that after the completion of Congressional investigation into Indian education in 1969 consensus prevails among educators to the effect that if Indian children do not differ in innate mental abilities, other casual

factors must be present to account for the unacceptable levels of academic achievement demonstrated by these children. There is sufficient evidence throughout the three-volume report on the Hearings before the Subcommittee of Indian Education of the Committee on Labor and Public Welfare, United States Senate, Ninety-First Congress to indicate substantially substandard academic performance is universally demonstrated in Indian schools whether educators class those schools as "poor", "adequate", or "excellent" in comparison to generally held ideas about curriculum, instruction, and plant facility.

In 1957 Havighurst cautiously stated:

The conclusion which is drawn by most social scientists from the data on Indian cultures and Indian intelligence is that the American Indians of today have about the same innate equipment for learning as have the white children of America. But in those Indian tribes which have preserved their traditional cultures to some extent, there is a limited motivation of children for a high level performance in schools and colleges. (Havighurst 1957, p. 113).

More recent reports in the literature reflect some disagreement with the final sentence in the above quotation citing the emphasis tribal authorities place on adequate education for Indian children and the increasing involvement of parents at all levels of education on the reservations since 1970. There is little reason to doubt numerous reports based upon empirical evidence obtained from the massive special and supportive education programs occurring in Indian schools will begin to reach the literature at an early date. Very few Indian schools are now without local programs involving test and measurement evaluation programs along the lines

reported by the Navajo Tribe (1973) and Indian educators in Alaska (Darnell 1972). Little suggestion is found in the literature surveyed to indicate research and testing programs in Indian schools focus upon specific factors of basic cognitive process like visual perception and recall. But, in those articles concerned with presumptions of learning theory, exemplified by M. Segal and V. John, knowledgeable educators are of the opinion that cognition among Indian children is even less understood than it is for Caucasian children.

Perception and recall are closely linked in the literature with perceptual analysis, and occasionally appear as virtually synonymous terms. The former is sometimes viewed as a developmental stage of the same cognitive function. Perceptual analysis has been linked with the ability to solve problems requiring insight into and application of unconventional methods. Poe (1951) suggests research specialists in the physical and biological sciences rely on the ability to recall visual images in cognition. Arnheim (1971) suggests the ability to draw objects in precise detail in the fashion common to Indian childrens' art is related to the ability to experience events and observe objects in an analytic rather than global fashion, and to subsequently recall them in detailed visual images.

Arnheim (1972 a, 1971 b) and Ellis (1972) both present convincing arguments with the context of their writing to the effect that assigning a heirarchal rank to cognitive abilities used in higher-level thinking processes is unwarranted. Visual recall and visual imagery tend to be linked with talent (as opposed to cognition) such as artistic aptitude. This may be a gross error in evaluating the

useful function of these skills in learning styles and functional cognition. Visual recall, when highly developed, may be favorably compared with a detailed photograph of objects or events that may be mentally viewed, all or in part, and quite possibly enlarged for retrieval of detail. Using this illustration, it is logical to expect persons with highly developed visual perception and recall skills to think in analytical and concrete terms more than those dependent upon verbal coding for recall of information. John (1972), and others in the literature frequently point out linguists remark upon the literal and concretely explicit imagery of Indian language structures. Most authorities agree language and cognition are closely linked, thus lending substance to the importance suggested by the data in this study in the degree of difference between the culturally different groups.

Among cross-cultural tests in visual perception that have occurred between Indians and a majority Caucasian culture, most notable are those of Perry (1966) who found like Annis (1973) for the Cree, Eskimo subjects surpassed Caucasian subjects in perception of diagonals. It was noted in Zintz (1969), for example, that Indian subjects tend to reach or exceed norms for non-verbal portions of commonly used standardized tests of intelligence in spite of the cultural bias associated with such tests. These portions of test batteries in common use for measuring intelligence are viewed, however, as a means of measuring analytic functioning in perception. Perceptual analysis is considered a mark of ability or potential ability in higher level cognition. The small but growing body of carefully designed research

subject to statistical analysis and explanation (in keeping with recommendations exemplified by Jacobs and Pazavich (1972) for conducting cross-cultural studies) is beginning to produce cumulative evidence that Indian people demonstrate a significant difference in visual perception and recall greatly exceeding that of contemporary Caucasians. Most notable of these are two studies using mainly adult subjects (Perry 1966, and Annis 1973) and one among Eskimo and Indian schoolchildren (Bland 1970).

In the final analysis, in relation to conducting cross-cultural research in education for the purpose of contributing understanding in the task of educating Indian children, J.E. Milholland (Boros 1972, p. 690) comments upon the current emphasis upon establishing national norms for mental ability tests: "It would seem that local school problems can best be attacked through use of local norms, and that the only really significant function served by norms is furnishing a scale."

Chapter 3

INSTRUMENTATION AND COLLECTION OF DATA

Instrument

No standardized instruments designed expressly to measure visual perception and recall abilities across cultures were described in the literature. Several standardized instruments, as well as clinical tools, were mentioned which place some emphasis upon measuring perception as a cognitive function, but none appear to meet the needs described for this study. One device was described in the literature as being pilot tested for collecting data regarding visual perception and recall abilities among Indian, Eskimo, and Caucasian children (Bland 1970). This measure is referred to as the "Squiggles Test."

A comparison was made between the Squiggles Test and other potentially useful devices mentioned in the literature. None appeared more valid or reliable than the one being pilot tested in Alaska by Bland and Sullivan (Bland 1970, Sullivan 1967, 1973). It was therefore decided to further adapt the Squiggles Test by imposing more rigorous controls on test administration and scoring and adopt it as the data collection instrument for this study. Permission was secured from Vernon Edy, originator of the Squiggles Test, and the device as adapted was retitled the Visual Recall Ability Indicator (VRAI) (Edy 1974). A detailed description of the VRAI including illustrated scoring protocols appears in Addendum A.

Population Samples

Two populations are sampled, (1) schoolchildren from reservation schools of two-hundred or more enrollment from Tribes of the single largest geographic concentration of American Indian tribal populations in the nation; and (2) schoolchildren from the three largest geographically isolated urban communities immediately adjacent to the reservation lands of the Indian sample population enrolling fifty percent or more Caucasian children attending schools of two-hundred or more students.

Indian Sample

The three largest tribal populations representing major cultural differences between tribes residing on adjacent reservations are the Navajo, Hopi, and Jicarilla Apache. These tribal lands contain one or more schools enrolling two-hundred or more children from the Tribe. The Indian sample is accordingly divided into three sub-sample units indicating subjects' tribal affiliation prior to any consideration of all Indian subjects as a group. The sample unit of Indian schoolchildren is limited to subjects aged eight through sixteen years currently enrolled (1974) in ungraded classrooms or grades two through ten in the schools sampled. This includes 2,627 Navajo, 472 Hopi, and 245 Jicarilla Apache subjects-- a total of 3,344 Indian subjects.

Caucasian Sample

The Caucasian sample is concurrently obtained from the three largest semi-isolated urban communities with predominantly within-municipality

Caucasian school enrollment located immediately adjacent to the reservation boundaries of the Indian population sample. These communities share the same natural environment and climate as the Indian population. They are similarly maintained by a development economy based upon farming or ranching, small-scale extractive industries, community support services, and tourism. The Caucasian sample is accordingly divided into three main subsample units indicating subjects' community residence prior to any consideration of all Caucasian subjects as a group.

The Caucasian sample unit includes subjects aged eight through sixteen years currently enrolled in ungraded classrooms or in grades two to ten in the schools where data were collected. Included in the sub-units are 396 subjects from Farmington, New Mexico, 160 Grants, New Mexico, and 241 Page, Arizona municipal schools -- a total of 797 Caucasian subjects (Table 1).

Sample Unit Selection

Sample units from the Indian population recognize the three largest tribal groups of the Four Corners region of the United States as well as taking into account the recognized cultural diversity represented by the three Tribes (Dozier 1970, Kluckhohn 1972). Both population samples share a region-wide common economic base, although it is recognized that a wide disparity exists between the dollar value derived by the two populations from the different income producing factors within the localized economies. Both populations benefit substantially in some form from federally appropriated monies. The Indian tribes, as administrative units, derive income

TABLE 1
POPULATIONS - AREAS, AGENCIES, AND MUNICIPALITIES

NAVAJO*			
Tuba City	21,945		
Chinle	2,289		
Shiprock	27,474		
Ft. Defiance	30,838		
Crown Point	28,322		
			110,868
HOPÍ**			6,567
JICARILLA APACHE**			1,963
		RESERVATIONS	119,398
FARMINGTON***	31,000		
GRANTS***	10,000		
PAGE***	9,000		
		MUNICIPALITIES	50,000

Sources: *Navajo Tribe, Office of Vital Statistics (June 1973).
 **U.S. Department of the Interior, Bureau of Indian Affairs, Washington, D.C. (June 1973).
 ***Estimates -- School District Superintendent Offices, January 1974. (written communication -- permission to quote secured).

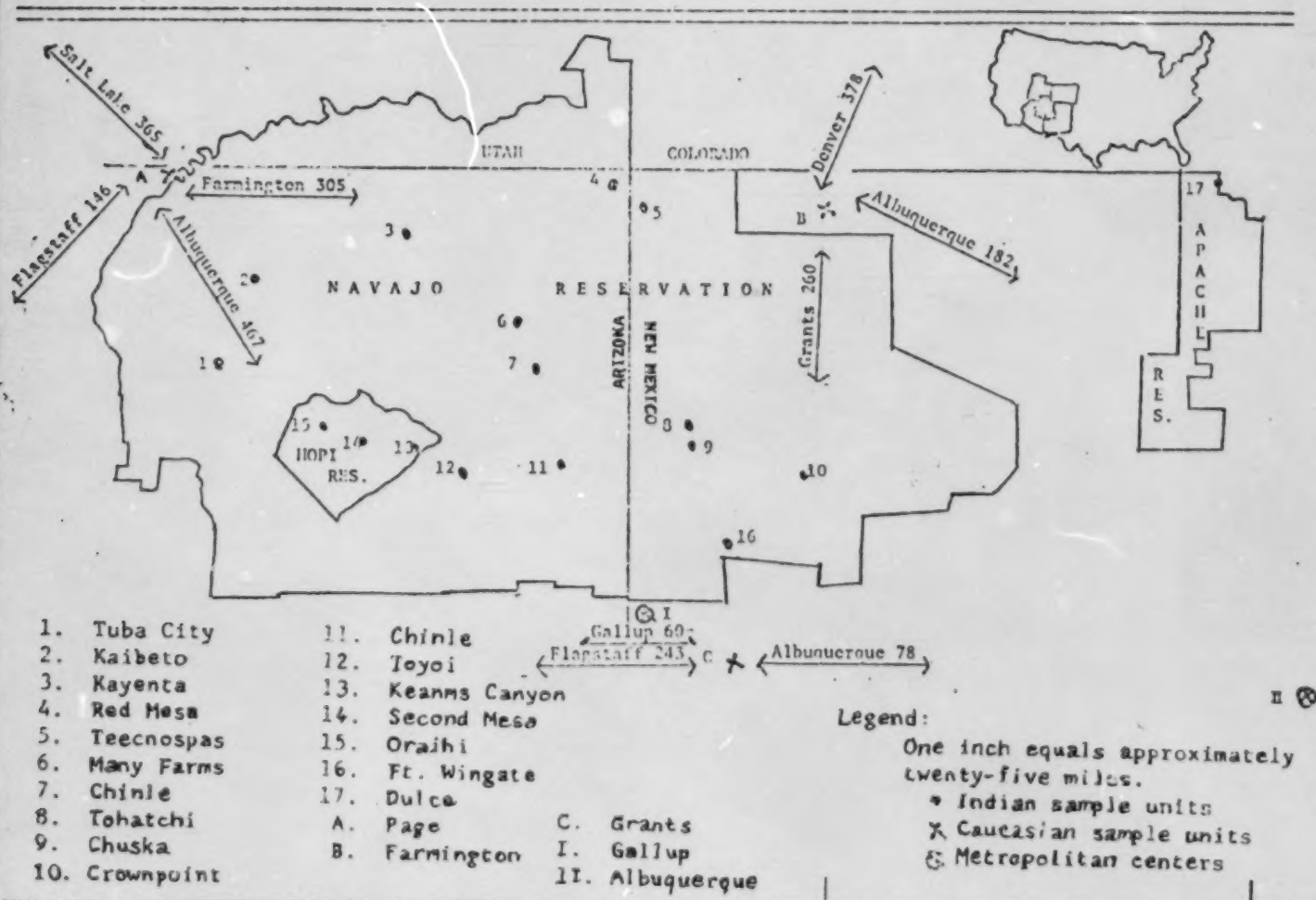
from the various factors within their economy on behalf of the Tribe. Both populations benefit economically from tourism. The Caucasian population sample is recognized as locally emphasizing certain factors more than others in deriving income, but taken together, the sub-units in this population sample can be said to share the same general economic base as the Indian population sample, although household and community incomes vary widely between and within sample populations.

Sub-sample units within the Caucasian sample unit recognize the socioeconomic differences implicit in small semi-isolated urban communities of the Southwest United States as well as the geographic criteria imposed by this study by including (a) one mining community (Grants), (b) one farming/ranching community (Farmington), and (c) one electrical energy/petroleum extraction industrial community (Page). Taken in total, both populations share a common ecological environment. All subjects of both populations reside within an ill-defined but generally understood geographic region of the United States known as the Four Corners (Figure 1).

The Indian schools sampled are located well inside boundaries of the respective reservations and exclude any urbanized reservation border towns with mixed or unusually large transient subpopulations of Indians, Caucasians, and Spanish-Americans. Caucasian schools sampled in a given community contained an enrollment of fifty percent or more Caucasian subjects. The urban communities sampled, in addition to geographic location and percent of Caucasian children

FIGURE 1

SAMPLE UNITS WITHIN THE FOUR CORNERS REGION



reported for local school enrollments, according to school authorities they also reflect a reasonable range within the Caucasian student enrollment for the socio-economic stratification commonly associated with the majority Caucasian culture of non-metropolitan Southwestern communities.

Specific criteria for selection of sub-unit samples are in part derived from practical constraints imposed by precautions related to climate and terrain suggested by tribal authorities from areas where data collection was performed, plus factors of time, distance, and cost as follows:

Indian and Caucasian Sample Units

1. Schools must operate upon untracked systems for assigning students to classrooms.
2. Students receiving remedial education support must not be segregated from the regular classrooms during data collection proceedings.
3. Schools must not be participating in longitudinal university-sponsored remedial programs involving visual perception and recall skill development emphasis.
4. Students clinically diagnosed as mentally retarded will not be included as subjects.
5. Schools classed by the Bureau of Indian Affairs as being located in border-towns will not be included for either sample population.
6. Permission or approval must be present from all appropriate levels of authority or administration regarding the schools to be included in the sampling.
7. School enrollment populations for Caucasian district municipalities must roughly parallel numerically population enrollments for Indian sub-sample units or Bureau of Indian Affairs agency administrative units.

8. The gross population from which the sub-units stem must be seen by school authorities to be a generally stable indigenous local population.

9. All subjects, when combined for both sample populations, must reasonably appear to share to some degree the same base-line income producing economic factors, climate, natural environment, and general geographic region.

Indian Sample

1. Schools must be located well within reservation borders.

2. Schools must be accessible by paved road.

3. School enrollments must be two hundred or more students unless specifically excepted in the interests of sample integrity.

4. Schools must be operated or primarily supported by the Bureau of Indian Affairs.

5. Boarding and day schools will be included for each Bureau of Indian Affairs area administrative unit.

Caucasian Sample

1. Public schools sampled within municipalities must hold enrollments of two hundred or more.

2. Within the municipal school to be sampled, the enrollment must hold fifty percent or more Caucasian students.

3. The total school enrollment of municipal schools must hold a minimum of fifty percent or more Caucasian students.

4. School authorities must offer reasonable assurance schools to be sampled afford a full representative range of the socio-economic levels of Caucasian families present in the school district.

5. Municipalities to be included in the sample must be semi-isolated from the nearest metropolitan center by terrain and distance.

Random selection of schools within sub-sample units was not always appropriate due to either failure to meet the criteria or because the schools meeting the criteria were the only ones representing a given geographic area. A representative sampling of populations is obtained by combining sub-samples within populations with a wide-spread geographically representational distribution within Indian sub-units. The Navajo Reservation is divided by the BIA into five administrative agencies: Chinle, East Navajo, Tuba City, Shiprock, and Ft. Defiance. Boundaries are generally determined by rivers, watersheds, or high elevations. In order to obtain a representative sample of Navajo subjects, boarding and day schools from each of these subdivisions were sampled sufficiently to provide that a minimum of ten percent of the respondents from a Navajo sub-sample unit originated from each one of these agencies.

One exception to the minimum two hundred enrollment criterion imposed upon both sample units occurs within the Hopi sub-sample. Three of the five Hopi Reservation schools were available for sampling. These represent the only two schools of Hopi with enrollments over two hundred, the third being about one-hundred seventy. The third school was included in the sub-sample in the interest of sample integrity, since it was then the only one of the three available schools with enrollment beyond the sixth grade.

Occasionally more than one school met sampling criteria within a sub-sample unit. When this occurred, random selection was employed. This same technique was applied whenever limited access to

TABLE 2
SCHOOLS MEETING ENROLLMENT CRITERIA (K-12)

SAMPLED		SCHOOL ENROLLMENTS		NOT SAMPLED	
<u>INDIAN</u> (by Agency)					
NAVAJO*				NAVAJO	
Chinle Elem. & Sec.	739			Lukachukai	583
Mary Farms Elem. & Sec.	1485			Pinon	302
		2224		Rock Point#	335
Chuska	605				1220.
Kinlichee	243			Dilcon	745
Tohatchi	334			Greasewood	605
Toyle	725				1350
		1907		Leupp	601
Fabito	459			Denneshotoso	261
Kenyata Elem. & Sec.	563			(Kayenta JHS (#))	
Tuba City Elem. & Sec.	906				862
		2008			1842
Red Mesa**	433			Shiprock	377
Tecnospas	657				377
		1090		Dzilthnao-	
Crowpoint Elem. & Sec.	759			dithhle	327
Winmate Elem. & Sec.	1654				327
				Hopi	0
HOPi*					
Keams Canyon					
Elem. & Sec.	280				
Second Mesa	279				
Oraibi	148				
		707			
JICARILLA APACHE**				JICARILLA APACHE	0
Dulce Elem. & Sec.	595				
		595			5116
		8537		TOTAL	5716
TOTAL					
<u>CAUCASIAN</u> (by school district)					
FARMINGTON**				FARMINGTON	
Northeast Elem.	393			Ladera	393
Hermosa JHS	658			McCormick	333
Farmington IIS	1591			McKinley	326
		2642		Mesa Verde	253
				Swinburne	261
				Tibbetts JHS	546
					2712
GRANTS**				GRANTS	
Mesa View Elem.	570			Mt. Taylor	300
Webster JHS	600				300
Grants IIS	890				
		2060			
PAGE**				PAGE	0
Page Comm. Sch.	2338				
		2338			
ESTIMATED TOTAL		7032			2472

Sources: *U.S. Department of the Interior, Bureau of Indian Affairs
Fiscal Year 1973 Statistics Concerning Indian Education,
Washington D.C., 1974

**School District Superintendent's Offices, January 1974,
enrollments for Farmington, Page and Dulce; average
daily attendance for Grants, (written communication).

#Not specifically available, reflected in total enrollment.

Navajo school-communities met the selection criteria: fourteen were sampled. All Hopi schools meeting the criteria were sampled as well as the single Jicarilla Apache school. Eighteen Indian sub-sample school-communities are included in the Indian population sample totaling 3,344 subjects. Between the ages of eight and sixteen, approximately ten percent of the Navajo, fifty-eight percent of the Hopi, and thirty-four percent of the Jicarilla Apache school-children are included in the Indian sample. In total, approximately twenty-four percent of the Indian children between the ages of eight and sixteen enrolled in the combined schools of the three reservations compose the Indian population sample (Table 2).

TABLE 3
ESTIMATED SCHOOL ENROLLMENT K-12 - ESTIMATE OF ETHNIC ORIGIN

SCHOOL COMMUNITY	TOTAL ENROLLMENT	INDIAN or CAUCASIAN	PERCENT ENROLLED
NAVAJO*	20,596	20,596	100%
HOPÍ*	1,053	1,053	100%
APACHE**	595	475	80%
INDIAN		22,124	100%
FARMINGTON**	6,809	5,447	80%
GRANTS**	3,410#	1,705	50%
PAGE**	2,338	1,754	75%
CAUCASIAN		8,906	

Sources: *U.S. Department of the Interior, Bureau of Indian Affairs, Fiscal Year 1973 Statistics Concerning Indian Education, Washington D.C., 1974.

**Estimates -- School District Superintendent's Offices, January 1974, (written communication).

#As above, refers to within-city schools only.

Of the Caucasian schools meeting the sample selection criteria, included are one elementary school in Farmington (randomly selected from five), one junior high (randomly selected from two), and one high school; one elementary school in Grants (randomly selected from two), one junior high and one high school; and grades two through ten in the single school complex at Page. Of the schools sampled, approximately thirteen percent of the Caucasian school-children enrolled in the municipalities of Farmington, fifteen percent of Grants, and twenty-one of Page were included in the Caucasian population sample. This represents an estimated nearly fourteen percent of the Caucasian children enrolled in grades two-through-ten of the combined three Caucasian sub-sample population communities (Table 3). The total Caucasian sample includes 797 subjects (Table 4).

Estimates for the number of Indian or Caucasian students enrolled in grades two through ten of the publicly funded schools serving the sample populations were extrapolated from the various records available. The estimate for Caucasian subjects is based upon actual enrollment or average daily attendance records using school district estimated minority child enrollment percentages from records maintained for Federal Government reporting purposes. Estimates for the Mescalero Apache subjects are based upon enrollment figures. Within-grade estimates for the Indian schools are extrapolated from Bureau of Indian Affairs statistical reporting for the most current year available (Table 4).

TABLE 4
PERCENT OF ESTIMATED TOTAL ENROLLMENT K-10 SAMPLED#
BY TRIBE OR CITY

	K-12 Enrollment Tribe/City	Percent En- rolled 2-10	Percent of Ethnic Origin	Sample Number	Percent of 2-10 (min.)
<u>INDIAN*</u>					
Navajo	20,596	61.2 (12,604)	100 (12,604)	2,627	.21
Hopi	1,188	66.7 (792)	100 (792)	472	.60
Jicarilla Apache	1,002	72.2 (923)	100 (923)	245	.27
TOTAL	22,786	(14,119)	(14,119)	3,344	(.24)
<u>CAUCASIAN**</u>					
Farmington	6,809	74.4 (5,066)	80 (4,053)	396	.13
Grants	3,410	69.2 (2,360)	50 (1,080)	160	.15
Page	2,338	65.8 (1,538)	75 (1,153)	241	.21
TOTAL	12,557	(8,964)	(6,286)	797	(.14)

#Note: Estimates are computed on the basis of available data, Indian estimates are enrollment figures by BIA administrative areas, Caucasian are January 1974 enrollments for Farmington and Page; January 1974 average daily attendance for Grants.

Sources: *U.S. Department of the Interior, Bureau of Indian Affairs, Fiscal Year 1973 Statistics Concerning Indian Education, Washington D.C., 1974.

**Estimates - School District Superintendent's Offices, January 1974, (written communication).

classrooms (for sampling purposes) occurred for a specific grade level at schools within sub-sample units. A second set of criteria governed such situations as follows:

1. One hundred percent sampling of all students present in grades two through ten to take place in each school sampled, conditions permitting.
2. A ten percent minimum of students present in appropriate grades is to be sampled in every school.
3. Indian schools will be a minimum of twenty miles apart or separated by Bureau of Indian Affairs administrative unit boundaries.
4. If more than one school within a sample sub-unit or administrative unit meets all selection criteria, random selection will be employed.
5. When conditions do not permit one-hundred percent sampling at any one school included in a sub-sample unit, random selection will be applied to obtain a minimum of ten percent of the students as subjects for each grade level included in the sample present at that particular school.

Collection of Data

Necessary approval and permission from Tribal authorities, BIA, and public school superintendents were obtained prior to implementing data collection procedures. Travel between the various schools and communities required approximately ten consecutive weeks and totaled more than six thousand miles. All data were personally collected by the researcher in order to maintain consistent and uniform administration of the instrument for this study, and to expedite data collection.

Six sample units were included in the study, three for the Indian and three for the Caucasian schoolchildren. Twenty-three

Navajo school-communities met the selection criteria; fourteen were sampled. All Hopi schools meeting the criteria were sampled as well as the single Jicarilla Apache school. Eighteen Indian school-communities are included in the Indian population sample totaling 3,344 subjects. Between the ages of eight and sixteen, approximately ten percent of the Navajo, fifty-eight percent of the Hopi, and thirty-four percent of the Jicarilla Apache school-children are included in the Indian sample. In total, approximately twenty-four percent of the Indian children between the ages of eight and sixteen enrolled in the schools of the three reservation compose the Indian population sample (Table 2).

Of the Caucasian schools meeting the sample selection criteria, those sampled were one elementary school in Farmington (randomly selected from five), one junior high (randomly selected from two), and one high school, one elementary school in Grants (randomly selected from two), one junior high and one high school, and grades two through ten in the single school complex at Page. Of the schools sampled, approximately thirteen percent of the Caucasian schoolchildren enrolled in the municipal schools at Farmington, fifteen percent at Grants, and twenty-one percent at Page. This represents an estimated fourteen percent of the Caucasian children enrolled in grades two through ten of the combined Caucasian sub-sample population communities (Table 3). The total Caucasian sample includes 797 subjects (Table 4).

Treatment of Data

Paw scores of each subject were recorded using standard six-columnar layout sheets.

Raw data as recorded was proofed using standard arithmetic cross-column balances. Data were then transferred to computer cards and verified by National Data Processing of Albuquerque, New Mexico. Data layout sheets were reviewed by a trained computer technician and re-verified.

The data were analyzed on an IBM 360-67 high speed computer at the University of New Mexico Computer Center. This center was selected because of the availability of the University of California at Los Angeles Statistical Package for Social Sciences (SPSS) computer program for one-way analyses for unequal N's treatment of data. Data required to test the twenty-seven research hypotheses derived from the hypotheses stated in Chapter 1 were inserted in the program by a trained computer technician.

Simple arithmetic calculations to obtain percentages used in discussion of the results of the study were performed on a Soundsign MAX II desk calculator. Perfect score/hand-eye dominance comparisons were similarly computed. Results were confirmed by a colleague. Data thus obtained is used in discussion and in describing some of the controls imposed upon the data collection procedure.

Chapter 4

RESULTS AND DISCUSSION

Results

Research involving large numbers of subjects dispersed over several thousand square miles is known to be subject to hidden variables, some of which the researcher may be aware of and others that are inadvertently overlooked. Several known covert variables beyond the control of the researcher that may affect results of this study include (for both populations) unknown incidence of culturally influenced affective response to undergoing tests like the VPAI, and the possible side-effects of conducting tests consecutively through the school day without regard for children's patterns of peak and slump performance periods. Other variables that may affect test performance include general levels of physical health and the conditions at the school plant facilities within and between the sample populations. The strategy for data collection was to sample ordinary children in ordinary schools of two culturally different populations. The number of subjects and geographic spread within sample populations serves to reduce the affect of hidden variables inherent in this study as far as seems reasonable.

Much of the literature related to the academic achievement and grade-level progression of Indian children in Indian schools remarks upon the consistent observations of over-age in grade-level and high drop-out rates in the upper grades. Due to this situation,

it was deemed most appropriate to group subjects by age rather than grade levels. Optimum sampling to obtain an estimated representational geographic distribution and minimum estimated ten percent within each of the seven sample units for two sample populations required obtaining data from all grade levels two through ten. According to school records for both populations to be sampled, the majority of students aged eight through sixteen are enrolled in these grade levels. In recognition of the developmental aspects of skills associated with cognition (including visual perception and recall), subjects are selected on the basis of age for recording data, although the data were collected from subjects on the basis of grade enrollment. Results from the data are stated in terms of late childhood (ages 8-10), adolescence (ages 11-13) and early adulthood (ages 14-16).

One variable that may have an effect upon raw scores within population samples is the incidence of crossed hand and eye dominance. This condition is viewed by some educational psychologists as a strong effector in copy demonstrations of visually perceived objects (Sullivan 1967). Accordingly, a comparison was made among population samples regarding the number of subjects reporting cross-dominance, number of perfect scores obtained within a population sample, and number of perfect scores obtained by cross-dominant subjects. Within the Indian population, 1303 (39%) of the subjects recorded cross-dominance, accounting for 661 (38%) of the 1736 (52%) perfect scores obtained by that sample. Within the Caucasian population, 273 (34%) of the subjects recorded cross-dominance accounting for 103 (41%) of the 251 (32%) perfect scores obtained by that sample.

These distributions compare favorably with each other, and fall well within one standard deviation from the mean for normal population distribution (Table 5).

Table 5
PERCENT OF HAND-EYE CROSS DOMINANCE WITHIN POPULATIONS

Percent	n	Perfect scores	Lateral-dominant perfect scores	Cross-dominant scores	Cross-dominant perfect scores
Indian	3344	.52	.61	.39	.38
Caucasian	797	.32	.59	.34	.41
Both	4141	.48	.82	.37	.18
Normal distribution = .68.2 ($.50 \pm 2$ SD)					

Throughout the following section reporting results of statistical treatment of the data, a one-side t-test at the .05 level of confidence is the critical level at which the null hypotheses as stated are accepted or rejected. The F ratio conforms to the t-test confidence level of .05 (10 percent). When, for purposes of discussion, other levels of confidence are mentioned, the F ratio appropriate for that t-test is used. Reference tables for determining the values of F and t are those in the Appendix in Popham and Sirotnik (1967), pp. 384-388, the same text recommending the various statistical procedures and models used in treating the data for this research (Popham and Sirotnik 1967, pp. 141 and 144).

Hypotheses

Table 6 displays results from treatment of the data regarding research hypotheses one through four. Hypotheses one through three are accepted. Hypothesis four is rejected.

1. There is no significant difference between the mean score for Indian boys and that for Indian girls. (Accepted)
2. There is no significant difference between the mean score for Indian boys ages 8-10 and that for Indian girls ages 8-10. (Accepted)
3. There is no significant difference between the mean score for Indian boys ages 11-13 and that for Indian girls ages 11-13. (Accepted)
4. There is no significant difference between the mean score for Indian boys ages 14-16 and that for Indian girls ages 14-16. (Rejected)

Table 6

AGE-GROUP MEAN SCORES - INDIAN SAMPLE MALE AND FEMALE AGES 8-16 YEARS

Sex	Age	Ethnic Origin	N	Mean	SD
Female	8-16	Indian	1851	7.98	1.35
Male	8-16	Indian	1493	8.04	1.20
Male and Female	8-16	Indian	3344	8.00	1.32
df = 1/3342	F = 2.56, p < .05		t = 1.60, p < .05		
Sex	Age	Ethnic Origin	N	Mean	SD
Female	8-10	Indian	553	7.55	1.52
Male	8-10	Indian	465	7.47	1.46
Male and Female	8-10	Indian	1018	7.51	1.49
df = 1/1016	F = .85, p < .05		t = .92, p < .05		

Table 6 (continued)

Sex	Age	Ethnic Origin	N	Mean	SD
Female	11-13	Indian	756	8.12	1.23
Male	11-13	Indian	570	8.07	1.12
Male and Female	11-13	Indian	1326	8.08	1.22

df = 1/1324 F = .46, p < .05 t = .68, p < .05

Sex	Age	Ethnic Origin	N	Mean	SD
Female	14-16	Indian	542	8.18	1.22
Male	14-16	Indian	458	8.59	0.86
Male and Female	14-16	Indian	1000	8.37	1.09

df = 1/998 F = 35.55, p < .05 t = 5.96, p > .05
> .01

Table 7 displays results from treatment of the data regarding research hypotheses five through seven. Hypotheses five and six are rejected. Hypothesis seven is accepted.

5. There is no significant difference between the mean score for the Hopi sample and that for the Navajo sample. (Rejected)
6. There is no significant difference between the mean score for the Hopi sample and that for the Jicarilla Apache. (Rejected)
7. There is no significant difference between the mean score for the Navajo sample and that for the Jicarilla Apache. (Accepted)

Table 7
MEAN SCORES BY TRIBE - INDIAN SAMPLE
COMPARISON: HOPI, NAVAJO, APACHE

Sex	Age	Ethnic Origin	N	Mean	SD
Both	8-16	Hopi	472	8.13	1.19
Both	8-16	Navajo	2627	7.99	1.34
Both	8-16	Navajo/Hopi	3099	8.01	1.32

df = 1/3097	F = 5.22, p < .05	t = 2.23, p > .05 < .01
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Sex	Age	Ethnic Origin	N	Mean	SD
Both	8-16	Hopi	472	8.13	1.19
Both	8-16	Apache	245	7.94	1.33
Both	8-16	Hopi/Apache	717	8.05	1.24

df = 1/715	F = 4.32, p < .05	t = 2.00, p > .05 < .01
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Sex	Age	Ethnic Origin	N	Mean	SD
Both	8-16	Apache	245	7.94	1.33
Both	8-16	Navajo	2627	7.99	1.34
Both	8-16	Apache/Navajo	2872	7.98	1.34

df = 1/2870	F = .31, p < .05	t = .56, p < .05
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Table 8 displays results from treatment of the data regarding research hypotheses eight through fourteen. Hypotheses eight, ten, and twelve are rejected. Hypotheses nine, eleven, thirteen and fourteen are accepted.

8. There is no significant difference between the mean score for the Caucasian boys and that for the Caucasian girls. (Rejected)

9. There is no significant difference between the mean score for the Caucasian boys and girls of Grants and that of the Caucasian boys and girls of Page. (Accepted)

10. There is no significant difference between the mean score for the Caucasian boys and girls of Grants and that of the Caucasian boys and girls of Farmington. (Rejected)

11. There is no significant difference between the mean score for the Caucasian boys and girls of Page and that for the Caucasian boys and girls of Farmington. (Accepted)

12. There is no significant difference between the mean score for Caucasian boys ages 8-10 and that for the Caucasian girls ages 8-10. (Rejected)

13. There is no significant difference between the mean score for Caucasian boys ages 11-13 and that for the Caucasian girls ages 11-13. (Accepted)

14. There is no significant difference between the mean score for Caucasian boys ages 14-16 and that for the Caucasian girls ages 14-16. (Accepted)

Table 8

AGE-GROUP MEAN SCORES - CAUCASIAN SAMPLE COMMUNITIES
MALE AND FEMALE AGES 8-16 YEARS

Sex	Age	Ethnic Origin	N	Mean	SD
Female	8-16	Caucasian	407	6.86	2.10
Male	8-16	Caucasian	390	7.18	2.04
Male and Female	8-16	Caucasian	797	7.01	2.07

df = 1/795

F = 4.75, p < .05

t = 2.18, p > .05
< .01

Table 8 (continued)

Sex	Age	Ethnic Origin	N	Mean	SD
Female	11-13	Caucasian	173	7.32	1.74
Male	11-13	Caucasian	165	7.48	1.84
Male and Female	11-13	Caucasian	338	7.41	1.79

df = 1/336 F = .79, p < .05 t = .89, p < .05

Sex	Age	Ethnic Origin	N	Mean	SD
Female	14-16	Caucasian	100	7.68	1.63
Male	14-16	Caucasian	98	7.94	1.51
Male and Female	14-16	Caucasian	198	7.81	1.56

df = 1/196 F = .13, p < .05 t = 1.16, p < .05

Table 9 displays results from treatment of the data regarding research hypotheses fifteen through twenty. Hypotheses fifteen through twenty are rejected. It should be noted that they may be rejected at the .01 level of confidence.

15. There is no significant difference between the mean score for Indian boys ages 8-10 and that for Caucasian boys ages 8-10. (Rejected)

16. There is no significant difference between the mean score for Indian boys ages 11-13 and that for Caucasian boys ages 11-13. (Rejected)

17. There is no significant difference between the mean score for Indian boys ages 14-16 and that for Caucasian boys ages 14-16. (Rejected)

18. There is no significant difference between the mean score for Indian girls ages 8-10 and that for Caucasian girls ages 8-10. (Rejected)

19. There is no significant difference between the mean score for Indian girls ages 11-13 and that for Caucasian girls ages 11-13. (Rejected)

20. There is no significant difference between the mean score for Indian girls ages 14-16 and that for Caucasian girls ages 14-16. (Rejected)

Table 9

AGE-GROUP MEAN SCORES COMPARED BETWEEN POPULATIONS

Sex	Age	Ethnic Origin	N	Mean	SD
Male	8-10	Indian	465	7.47	1.46
Male	8-10	Caucasian	126	6.17	2.25
Male	8-10	Indian/Caucasian	591	7.19	1.74
df = 1/589		F = 60.72, p < .05		t = 7.79, p > .05 > .01	
Sex	Age	Ethnic Origin	N	Mean	SD
Male	11-13	Indian	570	8.07	1.20
Male	11-13	Caucasian	165	7.50	1.84
Male	11-13	Indian/Caucasian	735	7.94	1.39
df = 1/733		F = 22.64, p < .05		t = 4.76, p > .05 > .01	

Table 9 (continued)

Sex	Age	Ethnic Origin	N	Mean	SD
Male	14-16	Indian	458	8.59	0.86
Male	14-16	Caucasian	98	7.94	1.51
Male	14-16	Indian/Caucasian	556	8.47	1.03
df = 1/554		F = 33.56, p < .05	t = 5.80, p > .05 > .01		
Sex	Age	Ethnic Origin	N	Mean	SD
Female	8-10	Indian	553	7.55	1.52
Female	8-10	Caucasian	134	5.65	2.30
Female	8-10	Indian/Caucasian	687	7.18	1.86
df = 1/685		F = 136.53, p < .05	t = 11.68, p > .05 > .01		
Sex	Age	Ethnic Origin	N	Mean	SD
Female	11-13	Indian	756	8.12	1.23
Female	11-13	Caucasian	173	7.40	1.84
Female	11-13	Indian/Caucasian	929	7.97	1.38
df = 1/927		F = 49.12, p < .05	t = 7.01, p > .05 > .01		
Sex	Age	Ethnic Origin	N	Mean	SD
Female	14-16	Indian	542	8.18	1.22
Female	14-16	Caucasian	100	7.68	1.63
Female	14-16	Indian/Caucasian	642	8.10	1.30
df = 1/640		F = 12.68, p < .05	t = 3.56, p > .05 > .01		

Table 10 displays results from treatment of the data regarding research hypotheses twenty-one through twenty-three. These deal with scorable test items on the VRAI. That is, test score #1 refers to the cumulative total of the first four scorable items in the VRAI, all simple geometric figures that should be equally familiar to all subjects in both populations. These items have a point value of one each, with a total possible cumulative score for Test item #1 of four points. Test item #2 conforms to VRAI test item 9, with a possible two point value. Test item #3 conforms to VRAI test item 10, with a possible three point value. Hypotheses twenty-one through twenty-three are rejected at the .05 level, but it should be noted they may be rejected at the .0005 level of confidence on the t-test used, and at the .001 level on a two side t-test.

21. There is no significant difference between the mean score for test score #1 for the Indian boys and girls and those for Caucasian boys and girls. (Rejected)

22. There is no significant difference between the mean score for test score #2 for the Indian boys and girls and those for Caucasian boys and girls. (Rejected)

23. There is no significant difference between the mean score for test score #3 for the Indian boys and girls and those for Caucasian boys and girls. (Rejected)

Figure 2

MEAN SCORES - MALE AND FEMALE POPULATION SAMPLES

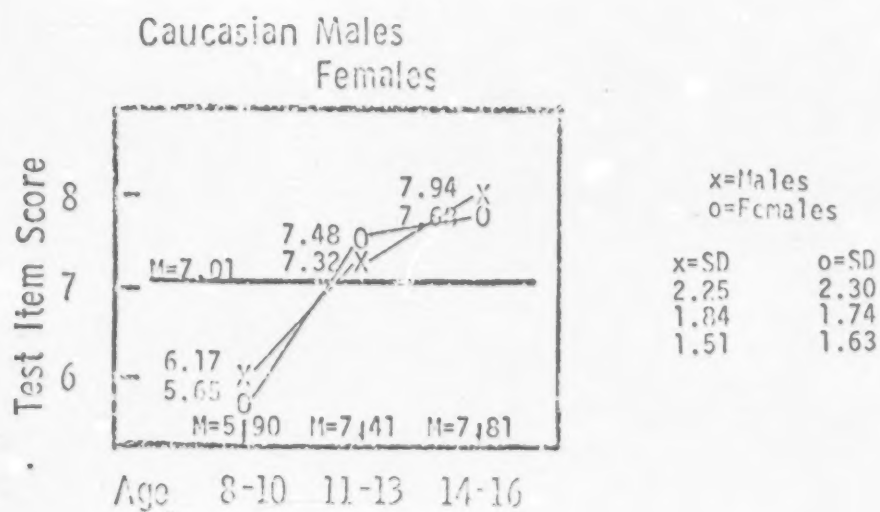
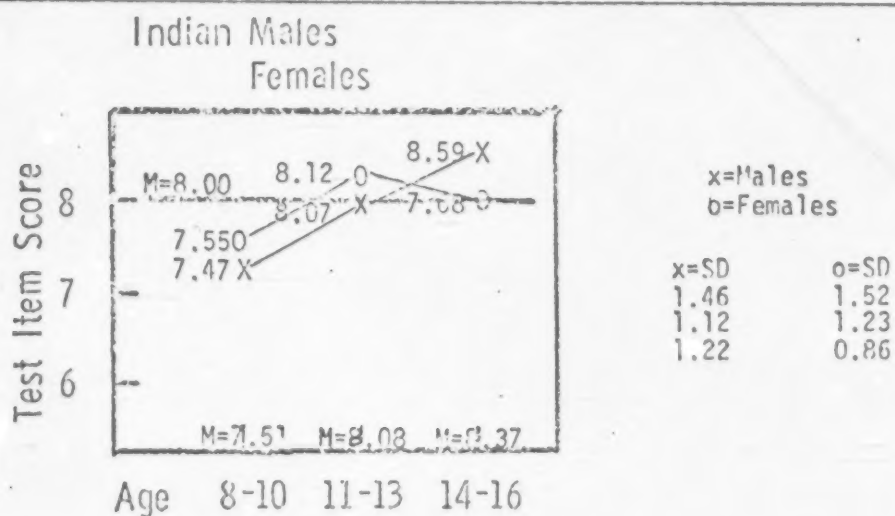


Figure 3

MEAN SCORES - MALE AND FEMALE SUBJECTS

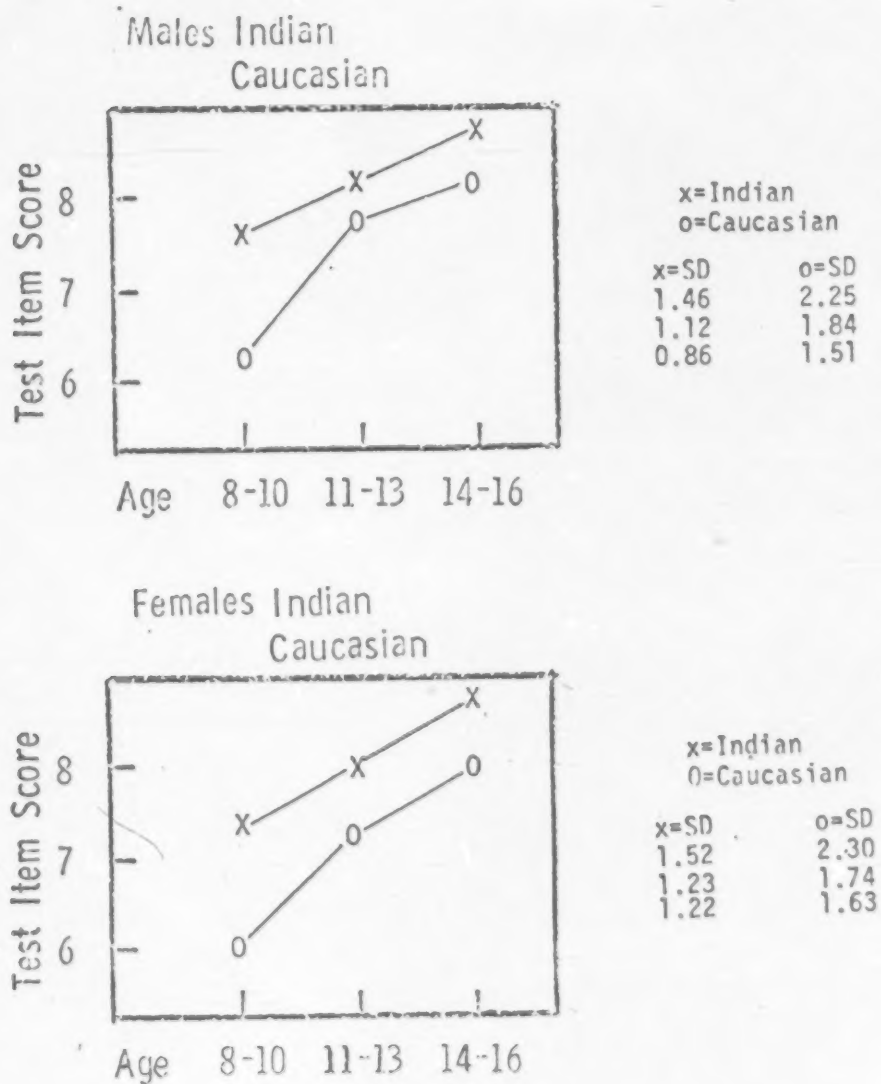


Figure 4

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MEAN SCORES - TRIBES AND CAUCASIAN COMMUNITIES

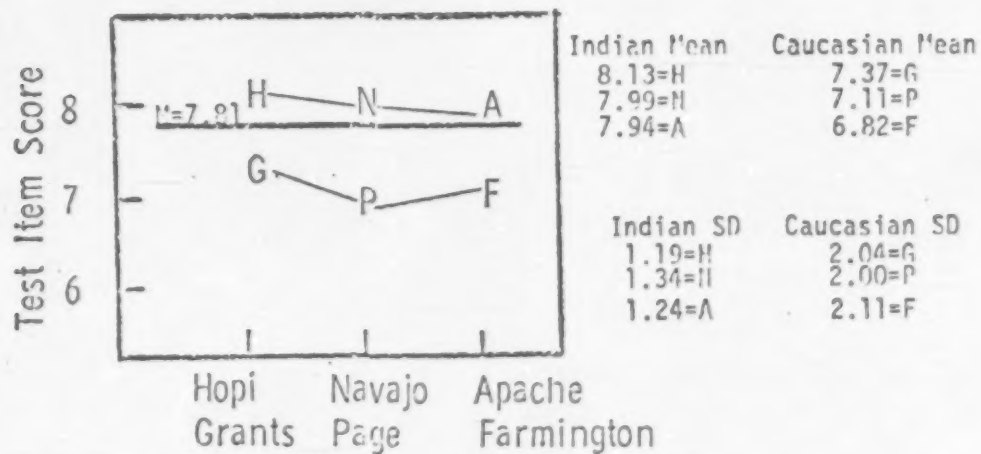


Figure 5

MEAN SCORES - TEST ITEMS

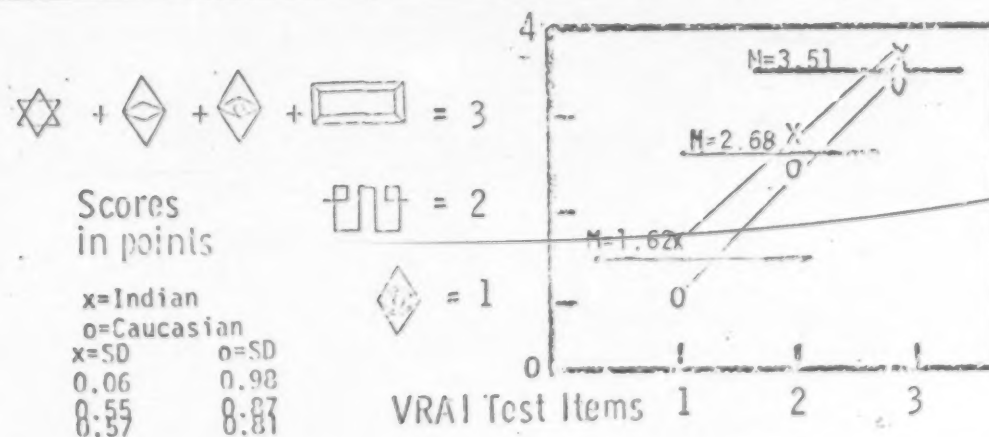
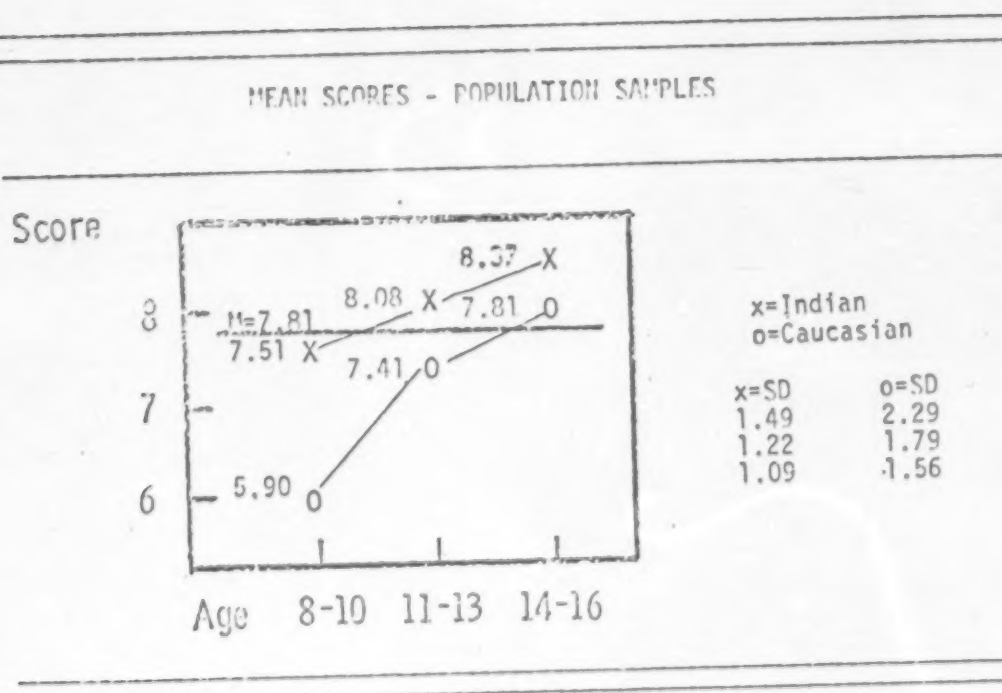


Figure 6



It should be noted that the F ratio for all tests indicates the populations being treated are homogeneous with the exception of hypothesis number twenty-four at the .05 level for the one-side t-test. When the two-side t-test is applied, the populations are homogeneous and the null hypothesis is untenable at the .001 level of confidence.

relation to this study other than to demonstrate the difference between the mean scores obtained by each sample population. Group means between and within the sample populations gain in both statistical and practical significance when they are interpreted in light of the standard deviations for those means. It should be noted standard deviations from the mean for any given test of hypothesis for the Indian population are very small when compared to the same test for Caucasians. This indicates that on the VRAI, Indian subjects uniformly and consistently reflect less variance within skill level by age-group and sex than do the Caucasian subjects.

Discussion

For all practical purposes, significant sex differences in visual recall do not appear within either the Indian or Caucasian samples. A statistically significant difference does appear at the .05 level within the Indian sample between boys and girls entering young adulthood, but does not appear between sexes as a whole. The same age group among Caucasians approaches statistical significance, and when the two groups are plotted graphically, both groups reflect a similar difference between boys and girls.

Also statistically significant is the difference among the Hopi and Navajo and Mescalero Apache samples, although differing only 0.03 from the mean for all Indian subjects. This is in keeping with the opinion of noted anthropologists like Kluckhohn and Dozier that

cultural differences associated with hunting and warring societal traditions (like the Navajo and Jicarilla Apache) and sedentary agrarian societies (like the Hopi) influence the degree to which learned skills are developed or valued. For practical purposes associated with this study, however, little significance is attached to this difference within the Indian sample. Thus, two of the three statistically significant differences in the Indian data may be of interest to anthropologists, but are seen of little practical significance to educators.

The third statistically significant difference conforms with age and education progression in visual perception and recall abilities as typically predicted by Anastasi (1968) for instruments like the VPAI. That is, Indian and Caucasian mean scores reflect an orderly increase from age eight through age sixteen. This is also in keeping with Havighurst's theory of developmental task accomplishment, since both the Indian and Caucasian samples reflect the greatest gain in mean scores between the late childhood and adolescent age categories. The implications for applied learning theory is found in the small gain in mean scores for Indian subjects (0.57) as compared with the remarkable gain for Caucasians (1.51). This suggests that Caucasian children are learning skills associated with visual perception and recall commonly found in the curriculum for kindergarten through fourth grade, while Indian children who already have these highly developed skills may be generally marking time and losing interest in academic tasks since they probably bear little relationship to what the Indian child expects to learn in school.

An equally important educational implication may be suggested by the disparity in rate of increase between mean scores of adolescence and young adulthood where mean scores for the Indian sample increase less sharply (0.29) than those for the Caucasian (0.40). This may mean that both populations have reached the normal optimum level for visual perception and recall abilities. It may be implied Indian students have not been educated to apply their greater cognitive strength in this area to cope with academic tasks presently demanded by a non-relevant curriculum presented through learning styles incompatible with their cognitive patterns, and instruction in what amounts to an inadequately learned and largely incomprehensible second language.

The disparity between mean scores within the Caucasian population sample should be noted. Educators generally assume Caucasian children enter a given school with the normal population distribution of levels of cognitive development. Although this sample (as representative of smaller characteristically Caucasian communities of the Southwest) is clearly inadequate, the data suggests that there may be more localized variances in the base-line levels of Caucasian children for cognitive functions like visual perception and recall than is generally assumed. The findings suggest additional research regarding the perception and recall ability levels of Caucasian children by geographic regions or some other common denominator may prove fruitful.

The Caucasian sample generally follows the response pattern predicted for measures of this type among the majority population. Statistically significant differences between sub-sample units within the population are seen of little general significance in relation

to implications for education of Caucasian children. Casual observations regarding the general nature of the populations of the communities within the Caucasian sample may provide a partial explanation for these disparities. Page is a new community, having been established within the past twenty years in response to the construction and maintenance of one of the nation's major dams and the subsequent development of the Lake Powell recreation area and a primary electrical generating complex. The population is generally made up of young blue-collar and manual-labor classification income-producing families. Typically, such a newly formed population is drawn from urban centers throughout the nation where children have less tendency to develop perceptual abilities associated with a more natural physical environment.

Grants is situated in a particularly harsh climate and by virtue of its small size seems more insulated than the other communities. This appears so in spite of the municipality being located on a major east-west interstate highway. Like Page, there is little ranching associated with the community and primary economic emphasis is on mining and transportation or tourism support services. Children in this community probably roam more freely in the natural surroundings than do the children of the other two communities.

Farminston, the largest community of the three, is centrally located in a fertile valley and it is doubtful that the majority of the children spend much time outside the metropolitan area except for occasional recreational excursions. Some variation in perception and visual recall might logically occur in response to the differing levels of need for these skills by the daily environment of the children and

due to a region-wide emphasis upon western-style sports and recreation.

The foregoing is not meant to suggest this small study does more than contribute to a growing body of knowledge and understandings about the culturally different Indian child. Considerable research must take place before a firm theoretical foundation can be described substantially sufficient for making assumptions generalizable to Indian children as a school population, or by tribal school populations. Both experimental and associative research may be required to fully establish the cognitive strengths of Indian children.

Should Indian children overcome the obvious handicaps to their learning categorized in the literature as being built into the present educational system in the reservation schools of the sample population, some speculation regarding reasonable implications for higher education seems justified by the data in this study. Occupations and professions associated with the arts and sciences are particularly linked in the literature with attitudes, for, or highly developed abilities in, visual perception, recall and analysis. Should adequate educational strategies in keeping with Indian children's cognitive strengths and learning style be developed and applied within context of a culturally relevant curriculum, it is reasonable to expect substantial increase in Indian childrens' academic achievement levels. With the doors of the universities and colleges open to them on the merits of their scholarly ability, without emphasis upon their ethnic origin, their apparently remarkable strength in cognition asso-

ciated with visual perception may enable them to make important contributions in many fields and highly technical occupations.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine through statistical procedures whether a significant difference exists in the ability levels of Caucasian and Indian children to perform identical tasks associated with cognitive functions of visual perception and recall. It is not the purpose of this study to demonstrate differences within the sample populations of either the Indian or Caucasian schoolchildren. It is assumed that in general terms both populations share the same fundamental formal education process in the schools under a virtually identical administration, instructional methodology, and curriculum-content formula.

The results of this study have shown a statistically significant difference in the ability of Caucasian and Indian schoolchildren of the sample populations to perform visual perception and recall tasks associated with cognitive function. The strength of this difference, statistically significant at the .0005 level on the t-test, strongly suggests that a basic difference in cognitive strengths and abilities does exist between Navajo, Hopi, and Jicarilla schoolchildren and Caucasian schoolchildren attending schools of similar size enrollments in communities sharing the same general geographic region as the Indian children. Furthermore, this difference is uniformly and consistently reflected between the age levels, and across the age levels, of both samples. The results clearly suggest Indian

children in the sample populations enter formal schooling with much greater strength in cognitive abilities associated with visual perception and recall than do the Caucasian children, and this strength continues throughout the major portion of the mandatory school-age period. In keeping with current educational philosophy that seeks to bring the child from an individual level of cognitive ability to the realization of intellectual potential through an orderly process of building upon cognitive strengths, the implications become apparent for the education of Indian children regarding an exceptionally highly developed aspect of cognitive function at beginning school age as compared to the dominant Caucasian culture's children.

The data reflects a normal distribution of individual ability in perception and recall within the sample populations. The difference between populations occurs consistently between the mean scores of the populations regardless of where on the scoring continuum a comparison occurs. This becomes educationally significant when applied to current practices in educating Indian children or indirectly to occupational areas which use such abilities to advantage. Instructional strategies and learning experiences that build upon Indian childrens' cognitive strengths, rather than expecting Indian children to spontaneously develop cognitive strengths prevalent in the dominant Caucasian culture may substantially enhance their academic achievement and grade progression. The literature frequently points out that Indian children apparently rely more on highly individual observational and experiential learning style than they do on verbally based instruction, both in and out of the classroom. This may suggest research in the classroom

should place more emphasis upon defining the nature of Indian childrens' visual perception, analysis, and recall as linked or discrete functions of cognition. Linguistic research should not be overlooked by educators because Indian languages in contemporary use may hold valuable insights into the role played by perception in Indian cognition. This is found in the degree and extent of emphasis placed upon communication of visual images within the language structures as well as the vocabularies.

2. An unknown number of Indian children reside in large metropolitan centers. In the Southwest, Albuquerque, Flagstaff, Gallup, and Phoenix all hold a relatively large permanent Navajo, Hopi, and other Southwest Indian population. Research is needed to determine whether second and third generation urban Indian children share to the same degree visual perception and recall cognitive strengths of their peers on the reservations.
3. Research is needed to define and describe effective and affective instructional strategies and learning experiences for Indian children in response to any reasonably strong results of research indicating their cognitive strengths are not being utilized in the schools.
4. Due to the primary role of the Bureau of Indian Affairs in Indian education and its fiscal capabilities, it should take a leading role in generating widespread quality research into the cognitive strengths of Indian children.

Conclusions

The general conclusions reached upon the basis of this study are:

1. The culturally different schoolchildren of the Navajo, Hopi, and Jicarilla Indian Tribes demonstrate a higher level of skill in cognitive tasks associated with visual perception and recall than do Caucasian children of the same age attending similar schools of the same geographical region.
2. Visual perception and recall is a primary factor in the cognition of the Indian children studied, and as such may be a determining element in developing a learning style that begins in early childhood and extends throughout adulthood.
3. The commonly used educational strategies and curricula that generally conform to White middle-class schools are probably incompatible with learning styles of children from the Tribes in this study, and may condemn them to being required to learn school-related tasks that are based upon their cognitive weaknesses as opposed to their cognitive strengths.
4. Research in Alaska, Canada, and among other tribes in the contiguous states now appearing in the literature indicates cognitive strength in visual perception and recall as it relates to the development of a different learning style from that held by the dominant population may be constant to all insular groups of descendants of American aboriginal people. Since a substantial number of children fall into this

category, further research into the cognitive strengths and learning styles of this nation's Indian children is both warranted and mandatory.

5. Current research indicates Indian children's mental abilities generally conform to that of the Caucasian population through early childhood and primary grades. Indications are that educational strategies now provided for Indian children do not meet their needs nor free their intellectual capacities so they may progress academically on an equal basis with their Caucasian peers; nor do they afford them equal opportunity to contribute to the nation's economy and their own future economic security.

6. The results of this study suggest localized differences in visual perception and recall abilities may be more widespread among the Caucasian population than generally supposed. Since this cognitive function may relate to individual learning style development, further research related to this difference among Caucasian schoolchildren may be warranted. It is recognized, however, that within this study the greatest strength demonstrated by Caucasian children was still significantly less than that of the Indian children.

7. The interpretation of research of this type is inferential and must be evaluated upon that basis. This study has assumed that the instrument used for data collection measures visual perception and recall as functions of cognition. It has also assumed that cognition is linked with perception at a very

early age and that culturally tied child rearing practices assigning visual observation and non-directed experimentation in preference to verbally directed and reinforced learning plays a major role in the development of learning styles of very young children. It is always possible that there may be other explanations for the results obtained. There is little doubt that the instrument used measured a significant difference in performance among Indian and Caucasian subjects. This is believed to be a difference in visual perception and recall skills and is associated with a learning style of Indian subjects believed to have been evolved by them as the most functional style for learning on the basis of early childhood experience. Other explanations for the difference might be attributed to compensatorial mechanisms developed by Indian children in order to cope with demands of the dominant society and the schools. They may find this type of test rewarding and challenging since it does not demand verbal or computational skills for which they have a limited command. Caucasian children beyond the fourth grade may find this test insufficiently challenging and therefore unconsciously do not attempt to perform skillfully on the tasks being presented. There may be instilled cultural values, or values transmitted by the schools that cause Indian children to prize proficiency in line graphics such as used in the test items, but skills that are not particularly valued by the dominant

society for its children past a very early age. These considerations require additional research.

Recommendations for Research

1. Recommended research in relation to the concerns expressed should be repeated for the same populations of this study as well as those of other regions with relatively large Indian school populations in light of the basic issues regarding possible differences in cognitive function and learning styles between the dominant and Indian tribal cultures.
2. It is recommended that institutions and Federal agencies with a vested interest in Indian Education institute, expand, and support careful research based upon empirical data related to the cognitive strengths and learning styles of American Indian and Alaskan Native children in order to develop firm foundations for learning strategies and curricula now being specifically designed to meet the needs of these culturally different children.

APPENDIX A

The Visual Recall Ability Indicator (VRAI)

as adapted

from

The Squiggles Test

1974

Squiggles Test: Designed by Vernon Edy
North Texas State University
Approximately 1945

Adapted by Laurel L. Bland
1974 (permission secured)

THE VISUAL RECALL ABILITY INDICATOR (VRAI)

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THE VISUAL RECALL ABILITY INDICATOR (VRAI)

Source: Adapted from an instrument originated and used by Vernon Edy of North Texas State University since approximately 1950 (Edy 1974). field tested and used by Troy G. Sullivan of the University of Alaska since approximately 1965 (Sullivan 1973); adapted and field tested by L.L. Bland, post-Masters student, University of Alaska in 1968-69 (Bland 1970).

Validity: Rests upon theoretical assumptions commonly associated with mental measurements of visual perception and recall tasks as demonstration of cognitive function (exemplified by Anastasi 1968).

Reliability: Independent five-person inter-rater reliability check using twenty randomly selected tests, $r = .9$ ($M=142$, $SD\ 2.5$, $N5$, $z = .0968$, $p\ .01$), and independent two-person inter-rater reliability check using one-hundred randomly selected tests, $r = .83$ (Bland 1970).

Instrumental Strategies

Purpose

The VRAI is a data collection instrument designed exclusively for the purpose of obtaining quantitative information from groups of subjects in such manner the data may be treated in order to compare differences in visual perception and recall abilities between the groups. Scoring and recording procedures are directed toward subsequent statistical treatment of the data using one-way open end analysis of variance. The device appears to be appropriate for comparison studies across cultures within the United States, and to date has been restricted to use between groups of Caucasian and American Indian subjects.

Background of the Instrument

The VRAI is adapted from a diagnostic instrument titled the Squiggles Test. This unpublished device is in limited use by reading therapy clinicians and reading specialists in a number of public schools (particularly in Alaska and Texas) (Sullivan 1967). In 1967 an effort was made to field test the device as a group-test instrument enabling teachers of reading to rapidly screen entire classrooms of students in order to identify those indicating gross visual perception and hand-eye coordination (visumotor) impairments. These students could then be re-tested on an individual basis. The field test was conducted in classrooms with a high proportion of Indian and Eskimo students. It was found that these subjects consistently obtained higher scores on the instrument than did their peers. Caucasian subjects' grade-level reading ability scores and Squiggles Test scores, and similarly those of Indian and Eskimo subjects were plotted on a correlation chart. No suggestion of relationship was seen between individual scores on the test and reading level abilities for the Indian and Eskimo subjects. The charts did suggest, however, a relationship between reading scores and the Squiggles Test scores for Caucasians approximating predictions associated with the instrument (Bland 1968). This relationship was interpreted by those evaluating the device to indicate the Squiggles Test functioned as expected for Caucasians, but it may have served to measure differences in visual perception and recall ability between Caucasian and the Alaskan Native subjects as well.

Since little is known about Alaskan Native childrens' cognitive strengths and weaknesses, it was decided to use the Squiggles Test in a pilot study to measure visual perception and recall abilities between Alaskan Native (Athabascan Indian and Eskimo) and Caucasian schoolchildren. The Squiggles Test was adapted through adopting a set of stringent protocols, specific data collection procedures, and a uniform method for group testing.

Results of the pilot study indicated the Squiggles Test, as adapted, was suitable for measuring differences between culturally different Alaskan schoolchildren in tasks of visual perception and recall since the results obtained in the rural areas replicated those incidentally obtained in the urban school. There was no doubt that a significant difference in the performance of the two sample groups occurred. According to opinion in the literature associated with mental measurements, it was reasonable to conclude the instrument does measure visual perception and recall of the test items. Results of the study suggested Alaskan Native subjects exceeded the performance of the Caucasian subjects at a statistically significant level (Table 1).

Table 1

PILOT STUDY: VISUAL PERCEPTION AND RECALL ABILITY BETWEEN VILLAGE ESKIMO AND URBAN CAUCASIAN SCHOOLCHILDREN						
	Eskimo			Caucasian		
	N	Mean	SD	N	Mean	SD
Age 8-10*	41	16.70	4.76	87	11.95	6.35
Age 11-13**	45	15.77	4.80	113	15.26	7.20
Age 14-16***	39	17.69	3.40	301	15.79	5.00
*t = 4.702 p < .01 **t = .518 n.s. ***t = 3.084 p < .01 f = 1.77 p < .05 f = 2.25 p < .01 f = 2.16 p < .01						

Source: Bland 1970.

With the permission of the originator of the Squiggles Test following the pilot study completion in Alaska, this device was strengthened and further adapted as a group-test instrument for the purpose of demonstrating differences in visual perception and recall between groups of American schoolchildren. At this time it was retitled the Visual Recall Ability Indicator (VRAI).

General Instrumental Strategies

The VRAI is designed to measure visual perception and recall ability among ordinary schoolchildren in ordinary classrooms. It is not a projective test and is not intended for any other interpretation other than those associated with skill levels appropriate to perception and recall, although it is recognized the items may bear close resemblance to items used in psychological tests and measurements (Anastasi 1954).

The VRAI is designed in response to cautions regarding data collection instruments to be used across cultures as found in appropriate literature and exemplified by Anastasi (1958), Cronbach (1973), Frake (1972), and Swartz (1972). In general terms, the VRAI introduces no time stress elements for subjects, uses configurations generally familiar to intended subjects, and may be considered valid for subjects of normal mental abilities above the age of seven years (Anastasi 1968).

Administering the VRAI to subjects (testing) is performed by establishing, in so far as is possible, a relaxed and responsive test atmosphere among subjects. The test is introduced as a game or test of self with no suggestion of competition with other individuals or groups implied.

The Squiggles Test, as indicated by its originator, patently originates in the Bender Visual Motor Gestalt Test (Edy 1974). Validity established for those portions of the Bender-Gestalt generally conforming to test items used in the Squiggles Test is regarded as transferring in equal strength to the minor adaptations present in the latter. According to Anastasi (1968), performance on the Bender-Gestalt is apparently independent of drawing ability, but among Caucasians is seen to be significantly related to the amount of education received by subjects. During extensive standardization of the Bender-Gestalt in the years just prior to 1964, it was suggested this test is useful as an assessment device in describing non-verbal development between ages five to ten. High validity was obtained when the instrument was used to access school readiness and in predicting the subsequent educational achievement of first-grade predominantly Caucasian children. Additionally, significant relationships were suggested between the scores and performance levels in reading and arithmetic in second-grade children.

The Bender-Gestalt emphasizes visual perception and hand-eye coordination responses to test items. It does not measure visual recall as a paired response with perception. This is the primary difference between the Bender-Gestalt and the Squiggles Test. By including visual recall as a linked response with perception, the Squiggles Test is viewed by its originators as valid beyond age ten, due to the fact persons of all ages demonstrate a full range of possible scores to be obtained on the Squiggles Test (Sullivan 1973).

Within the age group for which the VRAI is designed, three physiological maturation levels are normally reached by the subjects. These are late childhood, adolescence, and young adulthood. It is not known how these physiological changes may affect visual perception and recall as functions of cognition between different cultures. It was suggested in the pilot study some difference may occur between Eskimo and Caucasian children during the period of adolescence. Accordingly, the VRAI includes a reasonable age range sufficient to allow for any changes that may be due to the physical maturation process of intended subjects (Kleinfeld 1972).

The VRAI includes recording information regarding each individual subject's dominant hand and dominant eye. The procedure used is a gross demonstration and information obtained serves only incidental purposes in relation to the instrument. Specifically, if the percent of cross-dominance differs remarkably between population samples, or sub-samples within populations, the examiner may be alerted to possible variables affecting results in the data collected as it relates to presumed equalities among subjects. The exercise involved in determining hand-eye dominance generally amuses subjects and serves to dissolve any test anxiety that may be present while generally reducing or dissipating group hostility or other negative factors that may affect the testing atmosphere.

Normal courtesies are to be observed in obtaining necessary approvals or permissions well in advance of testing in schools. As appropriate, a full explanation of the purpose for administering the VRAI is given to administrators, teachers, or others who have within-school responsibility for students who will serve as subjects.

Testing

Sample units may be structured to suit an examiners needs within the general limitations of the instrument. Basic design of the instrument calls for collecting data from groups of subjects aged eight through sixteen years by administering the test to an entire classroom of children present on the day of test administration for grades two through ten. As a precaution, when the instrument is being used with a number of sample units, it should be determined if any of the intended sample sub-units have been exposed to similar testing or remedial skills development programs that include emphasis upon visual perception and recall.

Administration of the VRAI requires few materials, and with teacher cooperation may be accomplished by a single examiner in approximately twenty minutes. Materials needed are a chalkboard, eraser, chalk, ten-second timer (optional), test booklets, a supply of #2 pencils, and an Examiner Test Item Chart. The test booklets consist of eleven blank unlined pages of inexpensive standard letter-size white paper plus a mimeographed cover sheet--all stapled together in the upper left-hand corner. The cover sheet design is appropriate for young children (having illustrated blanks for entering hand and eye dominance), and calls for each subject's name (or sex, if older subjects desire anonymity), age, date of birth (for age validation--usually obtained from the teacher in the case of young children), and the name of the school. Additional information includes tribal affiliation or ethnic origin (Figure 1).

When scheduling a series of classrooms for testing, thirty minutes is allowed for each test period, and takes into account recess periods and/or students changing classrooms. This normally

Figure 1

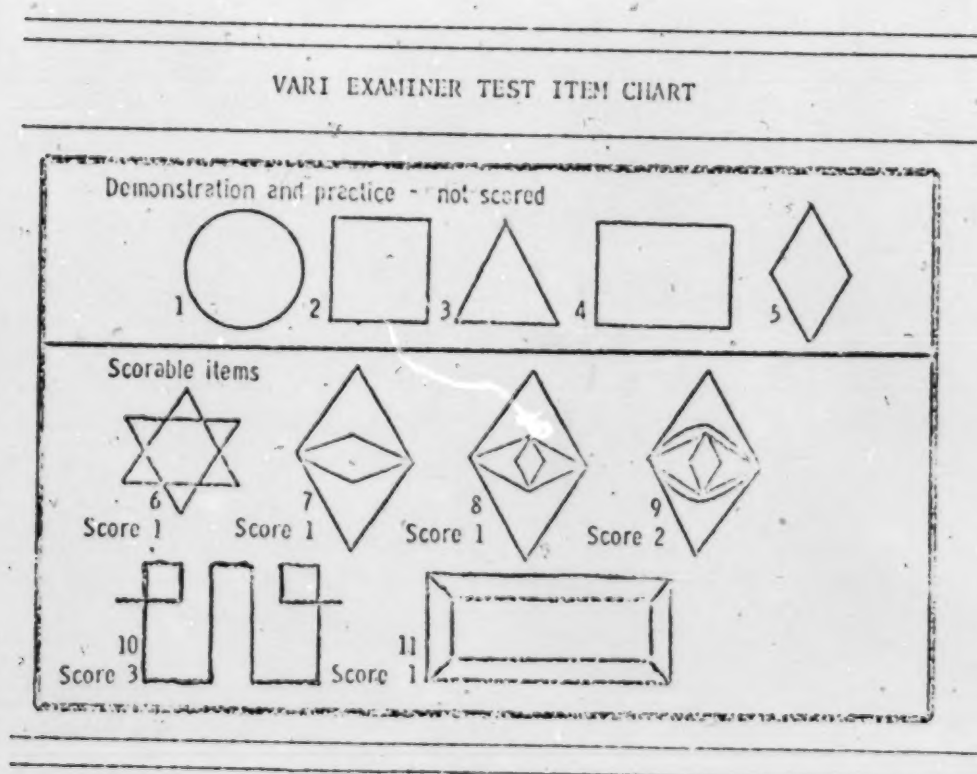
COVER SHEET - VRAI TEST BOOKLET

Mimcograph or ditto on standard 8-1/2 x 11" unlined white paper.

NAME _____	
DATE OF BIRTH _____	
AGE _____	YEARS
SCHOOL _____	
	TRIBE _____
	

permits some flexibility within the testing time period, and permits the examiner to aid younger subjects to fill in the cover sheet or to establish rapport with older ones. A brief orientation to the testing procedure is scheduled with teachers and administrators prior to a testing program in a school. At this time teachers are requested to assist by monitoring during testing, verifying birth dates or ages if needed, and by evaluating the examiner's test item demonstrations. This latter evaluation is intended to supply the examiner with information regarding visibility of test item demonstration for the group and how well the examiner's model item drawings conform to the Examiner Test Item Chart (supplied for the teacher prior to testing) thereby enabling the examiner to note deviations for scoring.

Figure 2



The VRAI consists of a series of eleven geometric figures (test items) presented in order of increasing complexity to groups of subjects. An examiner executes hand-drawn test items, one at a time, on a chalkboard. The examiner allows each test item to remain on view for approximately ten seconds before erasure. Upon a signal from the examiner, subjects reproduce each figure from memory after it has been erased. Size and placement of the drawing on the separate blank sheets of paper making up the test booklet are left to subject's discretion, but each new item is drawn on a separate sheet of paper without reference to the preceding one. The examiner is supplied with a master chart illustrating the test items in order of their appearance and point score values. This is not available to the subjects (Figure 2).

Rapport with groups of subjects is established while test booklets are being handed out (usually by one or more subjects) and the cover sheet is being completed. Since the VRAI is designed for use across different cultural groups, all instructions for subjects are given orally while they are concurrently demonstrated by the examiner using hand and body motions as appropriate. This is not meant to indicate pantomime in the literal sense, but a reasonable demonstration of what is wanted so speakers of a foreign language would have no difficulty comprehending the task. This method of communication is maintained with all groups sampled regardless of their ethnic origin.

Vital information is recorded by the subjects immediately upon receipt of the text booklets (to be varified by the teacher later if appropriate). This is followed by demonstrating and

recording of hand-eye dominance.

Hand dominance is established by having subjects vigorously shake their hands while looking away from desks where they have just placed a pencil. When working with groups, all subjects must shake hands in concert for a minimum of forty-five seconds. Immediately upon a signal to cease (given by the examiner), they reach forward, pick up the pencil, and hold it aloft to determine which hand dominates in the exercise.

Eye dominance is determined by having subjects place the palm of one hand on top of the back of the other while making a triangular opening between the thumbs. They then extend the arms full length from the shoulders while looking at the examiner through the peep-hole between the thumbs. A minimum distance of three feet is maintained between the subject and the examiner. Only one of the subject's eyes is visible to the examiner--the dominant eye. The examiner then may tell the subject to record either the right or left eye on the cover sheet of a test booklet.

This exercise is followed by introducing the test items, fully explaining the testing procedure before and during the practice exercise involving test items 1 through 5 (Figure 1).

Test administration is not a timed procedure from the subjects' standpoint, but it is governed by timing incumbent upon the examiner. Preliminaries and recording of personal data requires approximately ten minutes; demonstration and testing require from twelve to fifteen minutes. Prior to administering

the VRAI, the examiner must have acquired proficiency in executing each of the demonstration figures accurately within a specific number of seconds so the time each figure is before any one group of subjects remains constant between groups. Each completed model figure remains on view before the subjects for ten seconds before it is erased and subjects are given a signal to commence drawing. The examiner may use a stop-watch or a silent mental count to measure this period. The period allowed for subjects to reproduce the models from memory is not timed. From the subject's point of view, the test administration is relaxed, informal, and unhurried. From a vantage point at the chalkboard, the examiner is able to observe when all subjects have turned a page in the test booklet immediately after completing a drawing. This provides the signal to present the next test item. Experience has shown this seldom exceeds fifteen seconds for any figure.

Administration of the VRAI may be described in a step-by-step outline:

1. While test booklets are being distributed, in a vocabulary suitable for group age-levels subjects are informed about the reasons for the test, reassuring them it is not an academic achievement measure.
2. Personal data is recorded on the cover sheet.
3. Specific instructions for taking the test are given orally.
4. Instructions are demonstrated and repeated using the practice models, test items 1 through 5.
5. The six test figures are presented in silence except for the verbal signal to "draw what you see."

6. Subject's review cover sheet to assure it is completed.
7. Test booklets are collected.

Examiner responsibility in test administration involves soliciting teacher assistance in making sure subjects clearly understand the task being assigned and to unobtrusively monitor the class during test administration to insure instructions are being followed. Teachers are also asked to verify ages for younger subjects and to assist them in correctly recording hand and eye dominance.

Examiner performance in test administration may be outlined as follows:

1. Instructs subjects to remove all items from desks except a writing instrument, and distributes test booklets.
2. Instructs subjects how to fill in cover sheet and administers the demonstration for hand and eye dominance.
3. Instructs subjects in test procedures:
 - A. Observe the examiner draw a figure.
 - B. Do not begin to draw before instructed to do so.
 - C. Use a clean new sheet of paper for each different design.
 - D. Figures may be drawn large or small.
 - E. Figures may be placed in any location on the paper.
 - F. Try to reproduce the model correctly, but if more than one attempt is made, cross out the wrong one(s).
 - G. Turn the page immediately after a drawing is completed.
4. Demonstrates for subject practice the first five figures in the model series while repeating instructions, ending with items being demonstrated under identical conditions for the balance of the test.
5. Administers the test items to be scored in a time-paced sequence.
6. Unobtrusively monitors test performance.
7. Upon completion of the scored series, after admonishing subjects not to review their work, instructs them to review cover sheet to make sure all blanks are completed.
8. Confers briefly with teacher regarding observations during testing; makes any pertinent notes regarding same.

Scoring

Scoring is in accordance with the point values assigned each individual test item (as described below). Individual raw scores are recorded on the upper right hand corner of the test booklet for ease of transfer to data layout sheets at a later date. Scores are recorded thus:

cumulative score items 6, 7, 8, and 11/item 9/item 10

i.e., for the highest possible raw score = 4/2/3.

If the subject records crossed hand-eye dominance (right-hand/left eye--left hand/right eye) a large X is placed below the raw point score (using the example above; 4/2/3
X).

Using standard arithmetic tabulation procedures, raw data may then be transferred to columnar layout sheets by sex, age-group, and ethnic origin categories for the populations sampled. Data may be arithmetically verified by simple cross-balance of appropriate columns.

Nominal columns record crossed or lateral hand-eye dominance and top (9 point) scores using X if the variable is present, and - if it does not occur. This data may be used in whatever form is appropriate, depending upon the statistical or arithmetic treatment it receives.

Individual raw scores may range from zero to nine points derived on the basis of test item values as illustrated in the scoring protocols in Figure 3. Six items are scorable. The

first five items presented are demonstration and practice exercise, and are not included in subject's scores. All items to be scored must be clearly recognizable reproductions of the demonstrated counterparts drawn by the examiner, in addition to any other more refined scoring criteria. Primary emphasis in scoring is upon the ability of each subject to demonstrate visual recall by reproducing what was perceived as accurately as possible, with each part of the configuration properly placed and with the whole item in general proportion to itself.

For any given aspect of a scorable test item, whole or in part, a twenty-five percent tolerance for deviation from the model is acceptable. Any deviation beyond this level results in a scoring penalty appropriate to the total value assigned to the test item. Examples of item errors exceeding tolerance levels with attendant scoring penalties appear in the illustrated protocols in Figure 3.

Criteria subsuming scoring procedures appear as general scoring rules. The illustrated protocols reflect general assumptions for measuring visual perception and recall skill demonstration. That is, normal persons above the age of seven years are capable of reproducing clearly recognizable copies of the scorable test items. The order in which test items appear before subjects is progressively more difficult. Point values assigned to test items recognize some learning may take place regarding portions of the items since they are repeated in an

ascending order of complexity within the series. In determining raw scores, point values are assigned to the various test items in keeping with the amount of detailed recall required to reproduce them accurately.

In so far as it is possible, the purpose of the protocols is to permit the examiner to score subject's visual recall objectively under uniform criteria disregarding normal differences in writing and drawing skills that occur between the ages of eight and sixteen years. Scores are based upon the final attempt produced for any item. With these considerations in mind, if a reproduction is still questionable in light of the protocols, a score of zero is assigned to that specific item.

Experience to date using the VRAI with more than six thousand subjects shows erasures and repetitions are infrequent and usually occur with item 10. This is seen as an attempt to correct directional components or to make angles of the figure more precise. No scoring penalty is imposed for corrections on any figure to improve design precision. Failure to correct gross line or curve distortions does impose a scoring penalty. An examiner may not speculate upon the cause of a distortion as a deciding factor in assigning score points. Figures are scored upon the basis of what appears on the paper as the subject's final completed impression of the model.

Mark overs are permitted, and appear more frequently as

corrections than erasures or repetitions. This type of correction results in extraneous lines, "tails", or arcs incorporated in a drawing. No scoring penalty occurs provided the general impression of the drawing conforms to the model. Examples of this type of correction appear in the illustrated protocols (Part 2).

In general terms, scoring is designed to assign one point value for producing a clearly recognizable copy of the model, two points when a combination of straight and curved lines is required to complete the test item, and three points when directional aspects of configuration are required to reproduce the test item. Thus, test items 6, 7, 8, and 11 are scored at one or zero points; test item 9 two, one, or zero points; and test item 10 three, two, one, or zero points.

Figure 3

SCORING PROTOCOLS - VISUAL RECALL ABILITY INDICATOR

Part 1

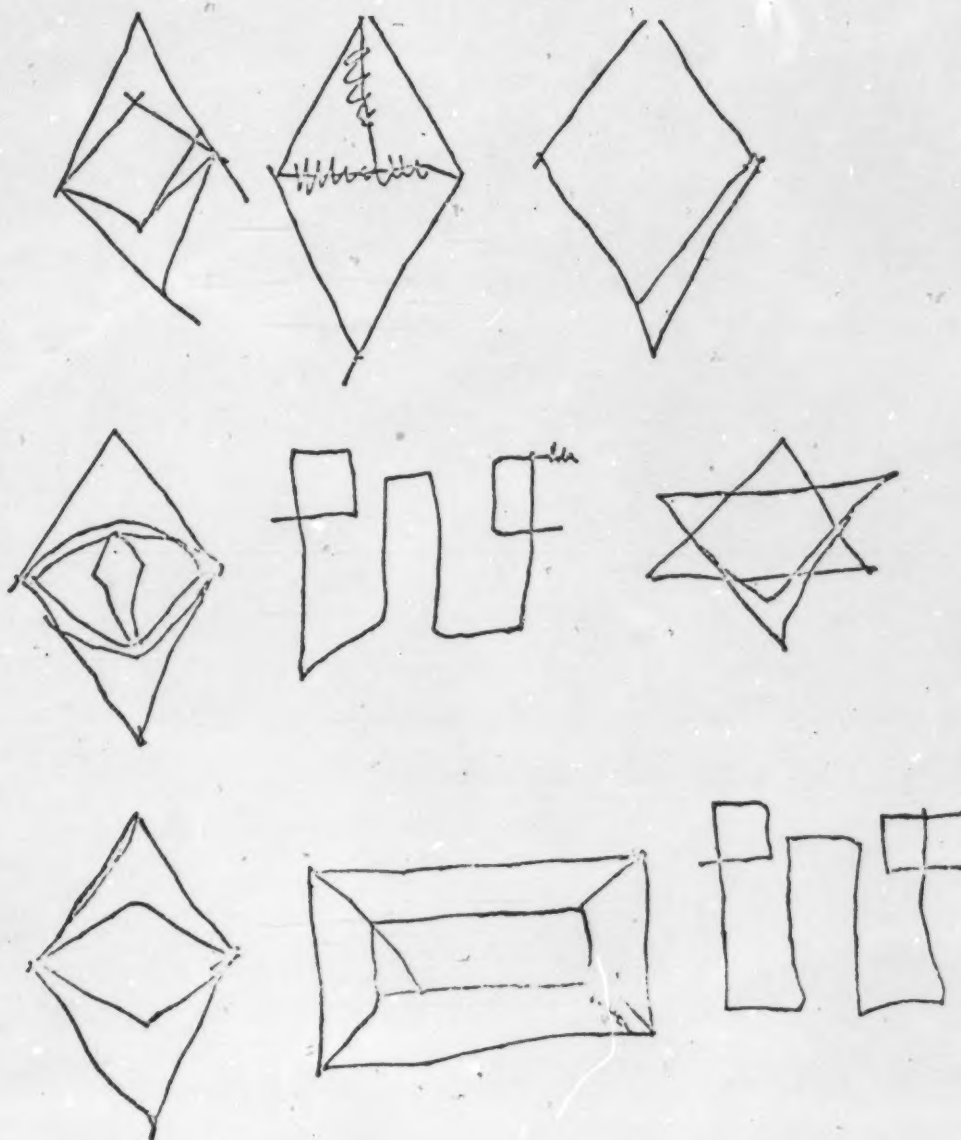
General Scoring Rules

1. Size of subject's drawings and where they are placed on the page of the test booklet is immaterial.
2. Neatness and drawing ability is immaterial.
3. Scoring criteria is the same for all subjects regardless of age or grade level.
4. When scoring, the first impression given by a subject's test item primarily determines the point value--that is, it either does or does not present a recognizable reproduction of the examiner's model.

5. The final drawing of a test item presented by a subject is scored regardless of other attempts on the same page.

Part 2

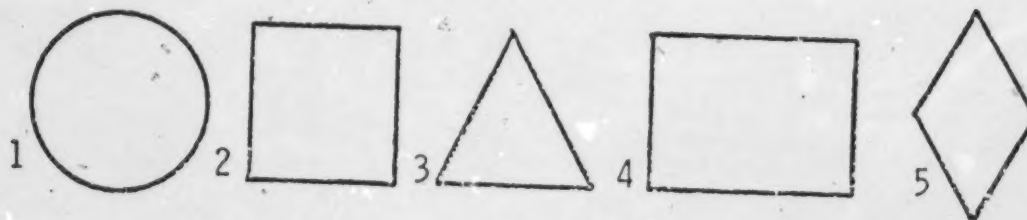
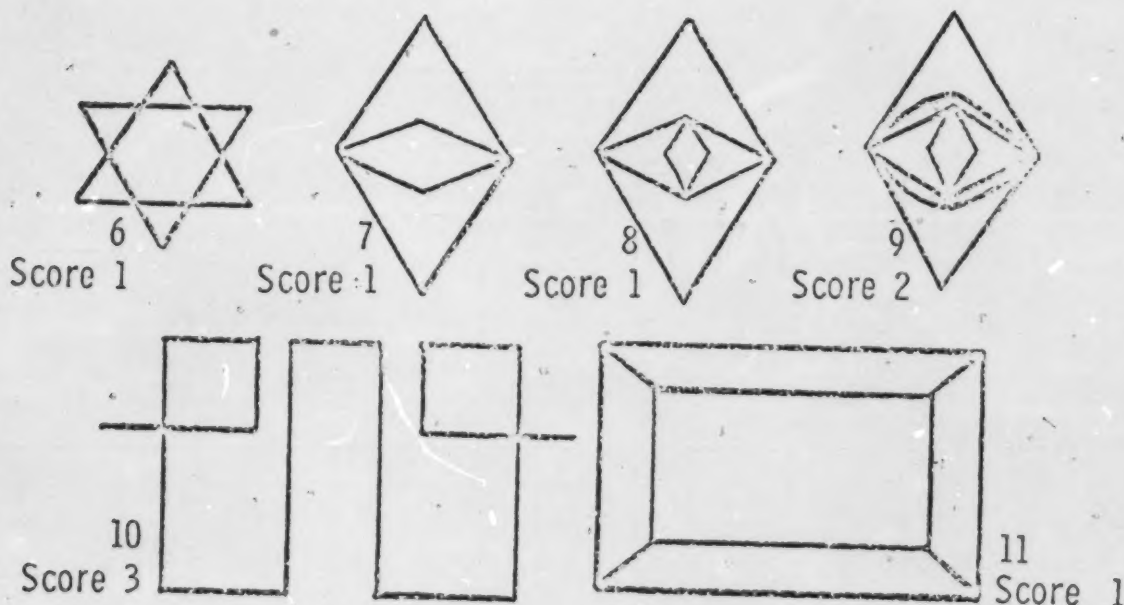
Examples of acceptable extraneous items in test item reproduction



Part. 3

Illustrated and annotated protocols

Demonstration and practice - not scored

Scorable itemsScoring detail Item 6

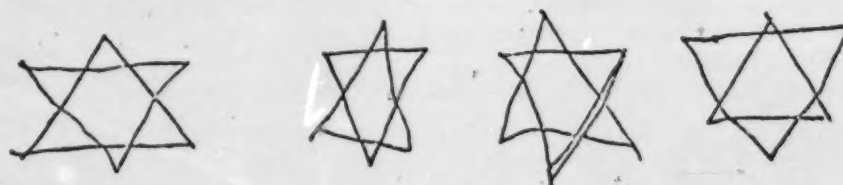
Item must be recognizable as a six-sided star. It does not need to be perfectly proportioned, but each star point must extend beyond the line it crosses.

Model: Point value=1

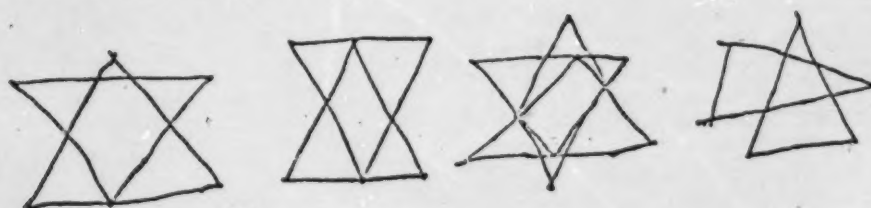


(Figure 3 continued)

Examples: Point value=1



Examples: Point value=0

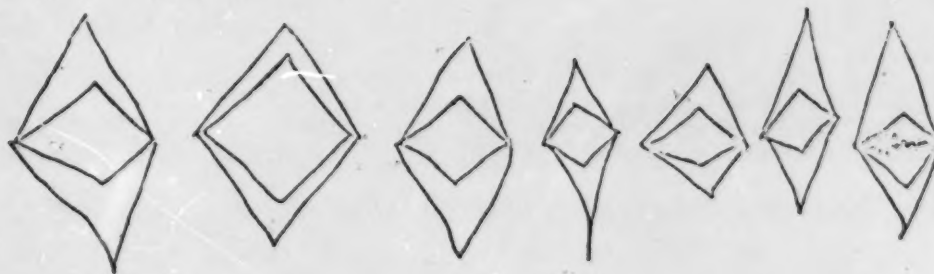
Scoring detail Item 7

Side tips of inner diamond need not align perfectly with each other nor the outside figure, but must depict a diamond within a diamond with side and top tips approximating points of outer top, bottom, and side tips, side tips of both converging.

Model: Point value=1

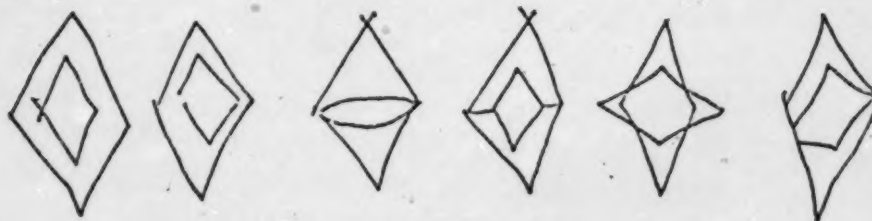


Examples: Point value=1



(Figure 3 continued)

Examples: Point value=0



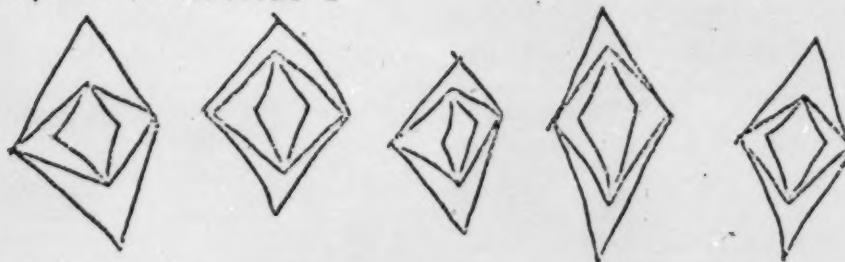
Scoring detail Item 8

As above in item 7, but new component must depict an elongated diamond for an "eye" effect, with top and bottom tips meeting or approximating top and bottom points of inner lateral diamond.

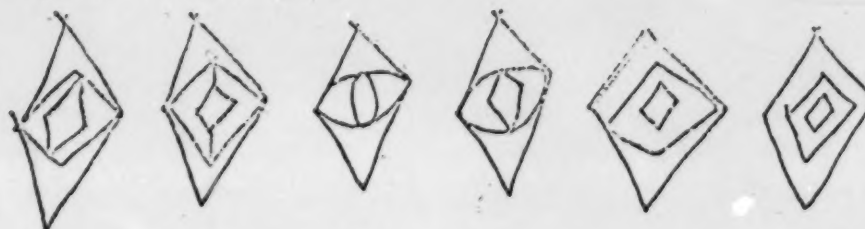
Model: Point value=1



Examples: Point value=1



Examples: Point value=0



(Figure 3 continued)

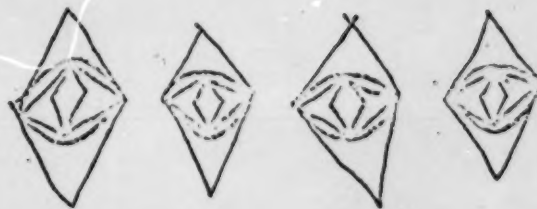
Scoring detail Item 9

As above items 7 and 8, but with new component added-- a full arc above and below the first inside lateral diamond. Each arc is a separate stroke from inside point of outermost diamond to its opposite side point. Both arcs must be present and positioned correctly for full point count. Arcs disproportionately positioned, performing an oval or appearing to dip above and below vertical innermost diamond (all other parts being correctly executed) reduce point value to 1.

Model: Point value=2



Examples: Point value=2



Examples: Point value=1



Examples: Point value=0

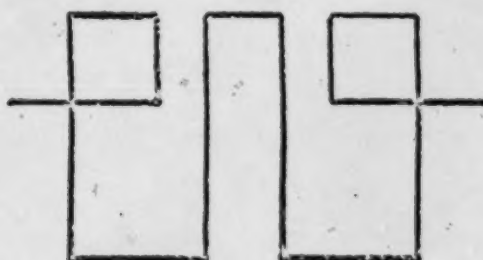


(Figure 3 continued)

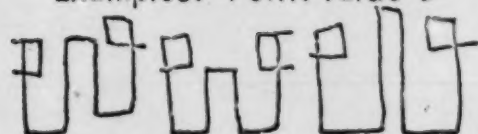
Scoring detail Item 10

This figure conforms to the outline of a rectangle with "tails" of inside boxes extending slightly beyond the right and left sides. Aspects of the configuration may depart from the model up to 25% the distance from the matrix of any one quarter of the imaginary rectangle without scoring penalty. End boxes are directional with short tails signifying beginning and end of the figure. Failure to execute tails reduces point value by 1, as does a single reversal of end boxes or other single sub-deviations from the model. Two sub-deviations such as double reversal of boxes result in a point value of 1. More than two sub-deviations result in a point value of 0.

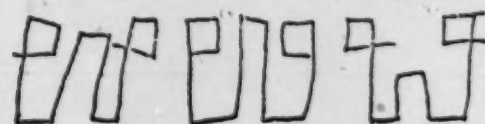
Model: Point value=3



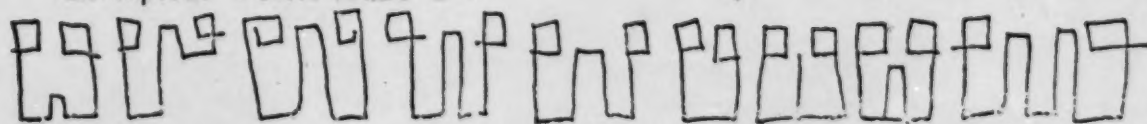
Examples: Point value=3



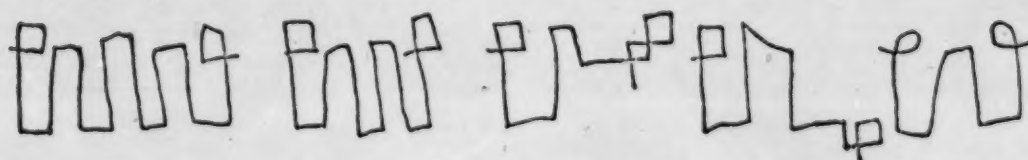
Examples: Point value=2



Examples: Point value=1



Examples: Point value=0



(Figure 3 continued)

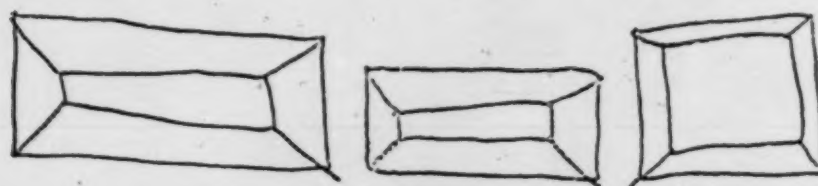
Scoring detail Item 11

This "picture-frame" figure may be either a square or a rectangle. Lines must extend diagonally from the outside corners of the inner figure to approximate the inner corners of the outside figure. Inner and outer figures must approximate each other on all four sides.

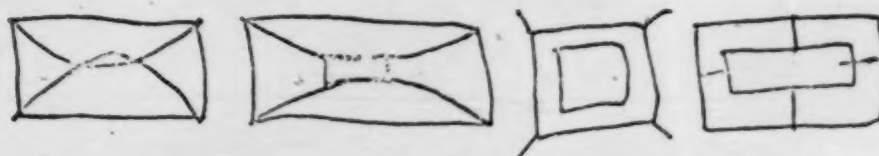
Model: Point value=1



Examples: Point value=1



Examples: Point value=0



Source of examples: Actual reproductions from subjects test booklets.

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APPENDIX B

Materials received from Troy G. Sullivan, University
of Alaska, dated (1) 1967 and (2) 1973.

Outlined by Dr. Troy Sullivan

(Class handout - 1967)

PURPOSE:

Identification of perception difficulties - may prevent frustration leading to academic or discipline problems.

Continual Evaluation - concepts can be used to interpret writing also.

Pupil Orientation vs Subject Matter - A teacher who must "cover" each page of a series thinks in terms of a class rather than each pupil. Understanding the student's reaction to the squiggles helps change teacher's point of view.

Chalkboard Utilization - Understanding of perception in learning emphasizes visual, auditory, and kinesthetic stimuli.

INTERPRETATION:

Perception - Subject sees you draw figure, stimuli removed - subject draws figure thereby displaying mental imagery, hand-eye coordination, spatial orientation, emotional involvement, and phonics readiness.

Emotions - if subjects use only #2 pencil, then evaluator of drawings will gain insight into variations of pressure; heavy pressure usually indicative of boldness, frustration or aggressiveness; light pressure may indicate timidity, withdrawal, insecurity or need of positive rewards. Size of drawing; small often indicative of small self image; large usually indicates outgoing behavior patterns.

Figures - Draw, then remove; watch subject draw (M. A. = mental age regarding coordination affecting reading skills)



M.A. 3 - circle closure, size similar to model



M.A. 4 - developmental tasks of parallel lines, horizontal and vertical coordinated to form box-- note left to right and top to bottom patterns regarding reversal and inversion tendencies.



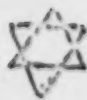
M.A. 5 - cross body coordination of diagonal lines - note closure of corners and isometry.



M. A. 6 - indicates readiness level - remembers whole sentence and at sight vocabulary building stage - parallel lines in unequal pairs, note left-right orientation.



M. A. 7 - Reading Level - can identify sight words in new context - note closure of lower apex, length of sides.



M. A. 8 - Phonic Level - abstract symbols mastered, can concentrate on sound and meaning of words. Symptoms of immaturity - cannot easily compose words from abstract sounds.



M. A. 9 -



= spacial disorientation - subject sees overall shape of word, misses internal detail - kinesthetic approach helpful in spelling, writing and thus reading.

(Anything he can write, he can read.)

SQUIGGLES
PAGE 2



M. A. 10 -



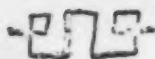
= slight interference



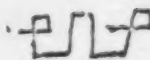
= gross interference



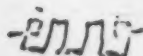
M. A. 11 - semicircle indicates mastery of continual change and control of coordination.



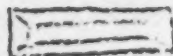
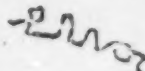
M. A. 12 - sensitive to reversal and cross dominance in youth or adults. Variations indicate need for determining unilaterality. (Hand with tube to eye, etc.)



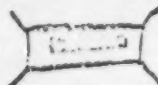
= mild interference often with reversals and misdirections- subject may be unaware of condition.



= gross interference, often organic, subject usually aware and emotionally concerned - kinesthetic approach helps regain confidence.



M. A. 13 - Three-dimensional representation.



= gross interference.

IMPLEMENTATION:

Confidence factor - by use of tracing techniques, subject can receive positive reward using large words; ex: carpenter, helicopter, sphygmomanometer, etc.

Individual Curriculum

Experience Charts

Study Centers

Reading Level Mobility

AV - tapes, viewers, listening labs, language masters, etc.

Student Access to Teacher

Student word collections - whisper, write, erase, observe, evaluate

Grading per individual vs class

Transition from "Teacher" to "Coordinator of Learning". This philosophy permits the teacher to utilize all skills and techniques she may possess. It permits a change in orientation toward the needs of each pupil and a corresponding flexibility of classroom procedures.

Reproduced with the permission of Dr. Troy Sullivan, University of Alaska, Reading Therapist - Langdon Psychiatric Clinic, Anchorage, Alaska.

University of Alaska, Anchorage

3211 Providence Drive
Anchorage, Alaska 99504

November 16, 1973

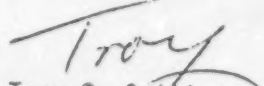
Ms. Laurel Bland
1600 Lomas N.W.
Albuquerque, New Mexico 87104

Dear Laurel:

The use of the Squiggles in the past with Caucasian population indicates that among the "normal" population above the 3rd grade, about 10% of the tests indicated some interference in the area of perception. In one test utilizing the "captive audience" at McLaughlin Youth Center, they indicated an 80% deficit in perceptual skills. The general statements that I have given you previously involved 25 years of research of my friend Mr. Eady (about 30,000 cases). Personally, in eight years of utilizing the Squiggles I have investigated between 2,500 and 3,000 cases. About 60% of those cases display error on Squiggles #12 and have a medical history of trauma prior to, or immediately following birth. The high correlation between reading difficulty and Squiggles malfunction is apparent in those cases where known brain injury is an element.

Good luck with your project.

Sincerely,


Troy G. Sullivan
Professor
Education

TGS/kj

APPENDIX C

TYPICAL TEST SAMPLES REVIEWED IN
INSTRUMENT SELECTION

Tests listed below appear in the Sixth (a) and Seventh Mental Measurements Yearbook (b) (Boros 1965, 1972):

- #447 Carlton Picture Intelligence Test (used for young children, timed performance, urban orientation), 1965, p. 700.
- #455 Deeside Non-verbal Reasoning Test (English-Welsh bilingual instrument for ages 10-12), 1965, p. 725.
- #456 Figure Reasoning Test (Non-verbal intelligence test, ages 10 and older), 1965, p. 725.
- #459 Gestalt Continuation Test (uses a pantomime performance by examiner; an experimental model used among Bantu adults), 1965, p. 747.
- #460 Goodenough-Harris Drawing Test (requires commercially manufactured test booklets, for ages 3-15), 1965, p. 747.
- #844 Anton Brenner Developmental Gestalt Test of School Readiness (uses number recognition, commercially manufactured test booklets), 1965, p. 1135.
- #848 Perceptual Forms Test (similar to Squiggles Test, still being tested in local community), 1965, p. 1136.
- #367 OISE Perceptual Reasoning Test (primary ages only, no data on reliability and validity), 1972, p. 688.
- #270 Otis Lennon Mental Ability Test (measures a wide range of mental abilities, a form of general intelligence test), 1972, p. 689.
- #273 SAFRAN Culture Reduced Intelligence Test (uses colors as part of instrumentation, still an experimental model), 1972, p. 691.
- #274 Test of Perceptual Organization (divided into verbal and non-verbal measurements, ages 12 and above), 1972, p. 693.

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Kendall/Punt, 1969.

CURRICULUM VITAE

Laurel LeHeux Bland

February 28, 1926
Spokane, Washington

EDUCATION

A.A., Anchorage Community College-Alaska, 1966
B.Ed. cum laude, University of Alaska, 1968
M.A., University of Alaska, 1969
Ph.D., University of New Mexico, 1974

EDUCATION/PUBLIC SERVICE

Seminar, Hebrew University-Israel, 1970
Legislative Appointee, Brookings Institute-Alaska, 1970
Expert Witness, Special Hearings in Alaska, U.S.
Department of the Interior, Office of Equal Employment
Opportunity, 1970
Consultant, Alaska Federation of Natives, 1970
Consultant, Alaska Council on the Arts, 1968
Consultant, Arctic Native Brotherhood, 1967

HONORS

Fellowship, Alaska Department of Education, 1968-1969

PROFESSIONAL EXPERIENCE

Instructor, Alaska Methodist University, 1970-1973
Coordinator, Southeast Region, Alaska Cross-cultural Education
Development/Alaska Rural Teacher Training Corps, 1974-

EMPLOYMENT

Director, Special Historical and Cultural Inventory of
Imuruk Basin (Alaska), 1969-1973
Research Assistant, Institute of Social, Economic, and
Government Research, University of Alaska, 1970
Research and Writing, Office of the Governor, Alaska
Human Rights Commission, 1967-1968
President and Director, Human Environmental Research Services,
Inc., 1968-

PUBLICATIONS

American Native Oral Tradition: Legal Safeguards and Public Domain (1975)
Eskimos of Northern Alaska (1974)
Perception and Visual Imagery Among School-Age Alaskan Eskimos and
Athabascan Children (1970)
Adult Basic Education Needs Assessment for Alaska (1970)
Manpower Needs Assessment for Constructing the TransAlaska
Pipeline and Recommendations for Training (1971)
Joblessness in the Arctic: A Manpower Paradox (1971)
First Biennial Report, Alaska Council on the Arts (1968)
Cues for Conference Management (1967)
Anchorage Head Start Parents Manual (1966)
Alaska Legal Services ess Manual (1968)

ETHNOGRAPHIC AND HISTORICAL PUBLICATIONS

People of Kauwruk (1973), assisted William Oquilluk to compile text
Careless Boy (in review 1974), based upon drawings of Peter Kakaruk
Native People of Alaska: A Historical Review (in review 1974)

V I T A E

Laurel LeMieux Bland, Ph.D.

BIRTH February 23, 1926
Spokane, Washington

ADDRESS 1921 West 17th
Kennewick, WA 99336

TELEPHONE (509) 586-9684
(509) 582-8678
(907) 277-8280 - Alaska

EDUCATION Ph.D., University of New Mexico, 1974
Dissertation: VISUAL PERCEPTION AND RECALL OF SCHOOL-AGE
NAVAJO, HOPI, JICARILLA APACHE, AND CAUCASIAN
CHILDREN OF THE SOUTHWEST based upon a pilot
study "Visual Perception and Recall of School-
Age Eskimo, Athabascan Indian, and Caucasian
Children of Alaska" - 1969
M.A., University of Alaska, 1969
B. Ed., cum laude, University of Alaska, 1968
A.A., Anchorage Community College, Alaska, 1966
Diploma, Rogers High School, Spokane, WA, 1944
Member: Cross-Cultural Education Seminar, Hebrew University,
Israel, 1970
Legislative Appointee: Conference on the Future of Alaska,
Brookings Institute, Anchorage, AK, 1970

HONORS Professor: Cross-Cultural Education, Lifetime Appointment,
Adjunct Faculty, Sheldon Jackson College, Sitka, AK,
1975
Fellowship for Graduate Study: Alaska Department of Education,
1968-69

PUBLIC SERVICE (representative selection)
Expert Witness (by request):
Special Hearing in Alaska, U.S. Department of the Interior,
Office of Equal Employment Opportunity, Anchorage, 1970
Consultant (by request):
Alaska Counsel on the Arts, 1968-
Alaska Federation of Natives (includes the majority of Alaska
Native Regions and a number of the now incorporated Vil-
lages) 1970-
Alaska Historical Commission, 1974-
American Indian Policy Review Commission, U.S. Congress,
Task Force Five, 1976
Vice President for Rural Education Administration, University
of Alaska, 1975-76
Alaska Human Rights Commission, 1967-75
Alaska Historical Society, 1968-74

Anchorage Operation Breakthrough, Greater Anchorage Area
Borough, 1972
Alaska Medical Association, 1970-72
Alaska Legal Services, 1968-72
North Star Borough (Fairbanks) Mental Health, 1970

PROFESSIONAL EXPERIENCE (representative selection)

President and Director: Human Environmental Resource
Services, Inc. (research and applied research), 1968-
Professional Consultant for Government and Private Industry
(contract services, references named upon request), 1968-
Director: Special Historical and Cultural Inventory of Inupuk
Basin and Adjacent Areas (Alaska), 1969-
Director: Southeast Region, Alaska Cross-Cultural Education
Development Program, Sheldon Jackson College, Sitka, AK,
1974-75
Assistant Professor: Education, University of Alaska-Fairbanks,
AK, 1974
Instructor: History, Alaska Methodist University, 1970-73
Technical and Research Assistant: Alaska Human Rights Commission,
Office of the Governor, 1967-70
Research Assistant, University of Alaska, Institute of Social,
Economic, and Government Research, 1969
Manager: Alaska Legal Services Outreach Office, Nome, AK, 1968-69

TRAVEL

Extensive travel throughout southern Canada, north and central
Mexico, across the United States, all of Alaska except the
Aleutian Islands, central Europe, Great Britain, and Israel.

INVITED PARTICIPANT/SPEAKER (representative selection)

Pacific Northwest Personnel Management Association (Columbia
Basin Chapter), 1977
Alaska Historical Society Annual Conference, 1972, 1973, 1976
National Committee on Indian Heritage Preservation, 1975
Southeast Alaska Cross-Cultural Education Consortium, 1974-75
Rocky Mountain Educational Research Associates, 1974
Southwest Association for Applied Linguistics, 1974
National Conference on Bilingual Education, 1973, 1974

PUBLICATIONS (representative selection of major works)

ALASKA NATIVE POPULATION AND MANPOWER: 1975 (1976)
"Status of Alaska Native Education: 1976, A Report for Task
Force Five" (1976)
RURAL ALASKA SOCIAL SERVICES NEEDS ASSESSMENT: 1975 (1975)
AMERICAN NATIVE ORAL TRADITION: Legal Safeguards and Public
Domain (1974)
ESKIMOS OF NORTHERN ALASKA: A Source Book (1973)
MANPOWER NEEDS ASSESSMENT FOR CONSTRUCTION THE TRANS-ALASKA
PIPELINE WITH RECOMMENDATION FOR TRAINING (1971)
"Joblessness in the Arctic: A Manpower Paradox" (1971)
ADULT BASIC EDUCATION NEEDS ASSESSMENT FOR ALASKA (Master's
Thesis) (1970)
BASIC BIBLIOGRAPHY IN ALASKA ADULT EDUCATION (1969)
FIRST BIENNIAL REPORT, ALASKA COUNCIL ON THE ARTS (1963)

ALASKA LEGAL SERVICES FIELD OPERATION MANUAL (1968)

CUES FOR CONFERENCE MANAGEMENT (1967)

ANCHORAGE HEAD START PARENT'S MANUAL (1966)

Special Ethnographic Books:

PEOPLE OF KAUWERAK: Legends of the Northern Eskimo (1973)

NATIVE PEOPLE OF ALASKA: A Historical Review (1974--in pre-publication review)

CARELESS BOY: Stories of the Inupiat (1977--in final re-write and under publisher review)